# Simple Span Steel Through Truss Bridge

## As-Built Model Only

**November, 2011**

# Virtis V6.2

# DETAILED EXAMPLE

# SIMPLE SPAN STEEL THROUGH TRUSS BRIDGE INPUT

# AS-BUILT MODEL ONLY


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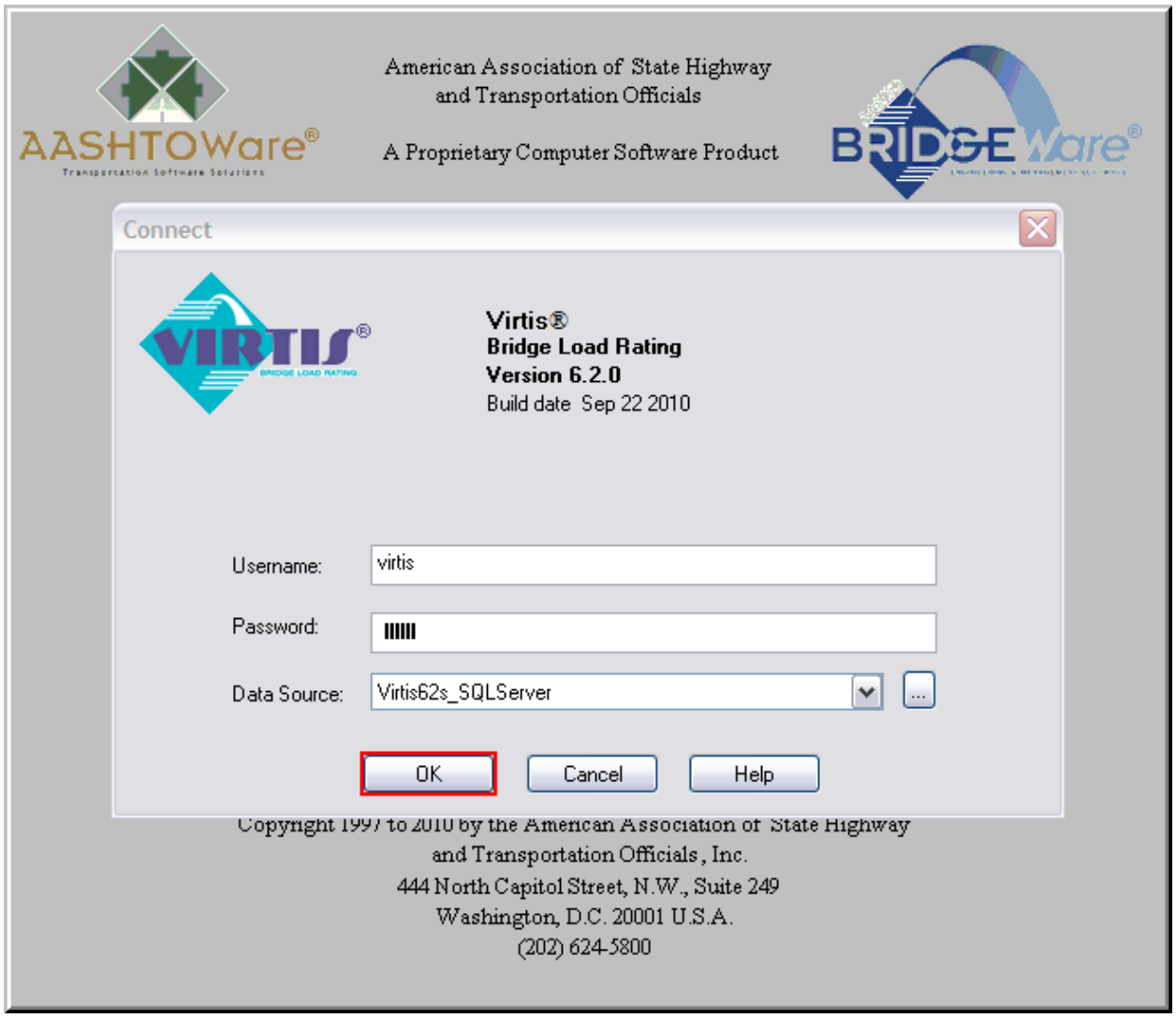
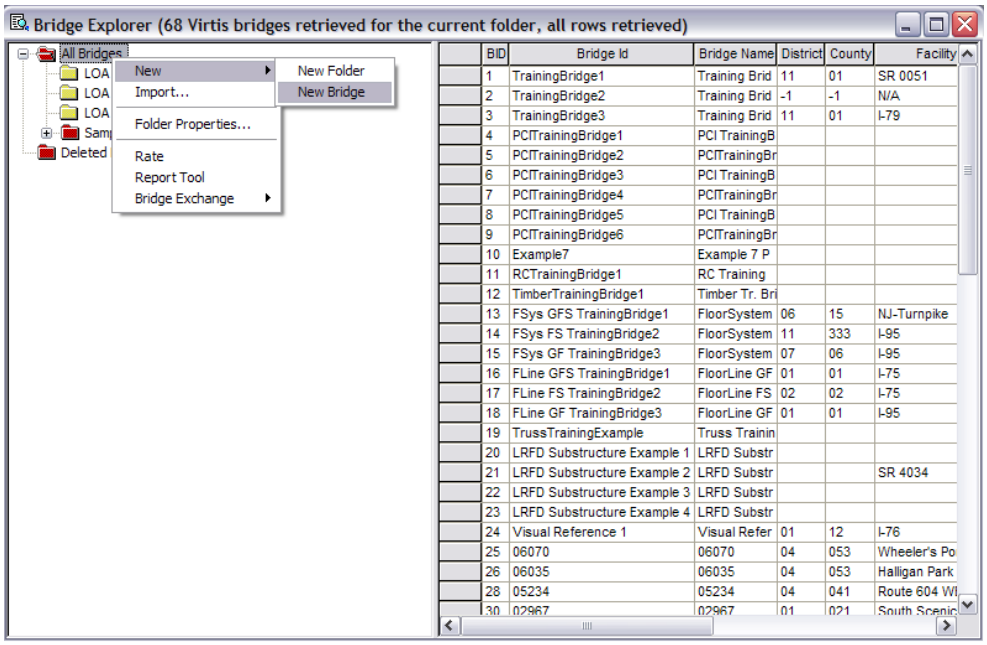
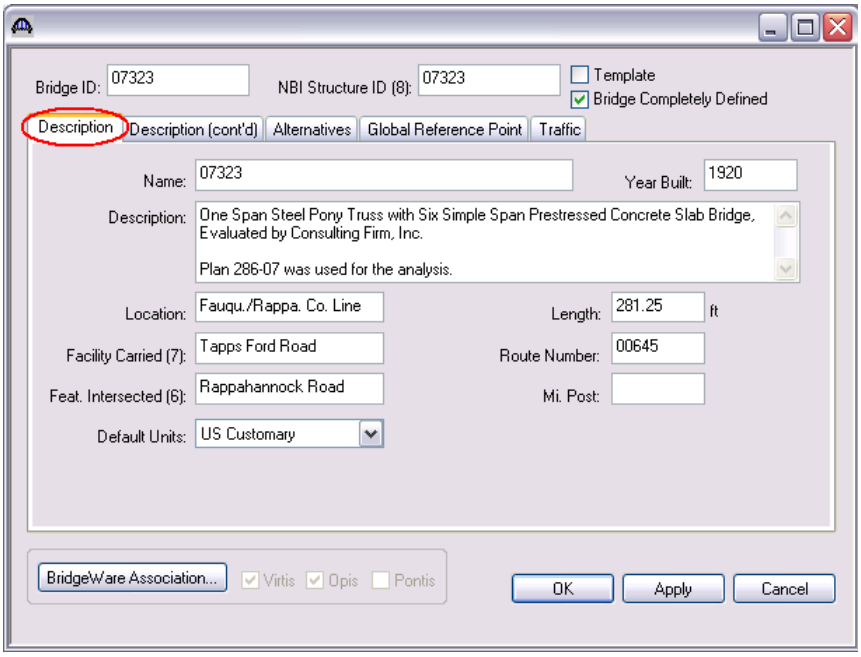

AASHTOWare®
American Association of State Highway and Transportation Officials
A Proprietary Computer Software Product
BRIDGEWare®
Connect
VIRTIS®
Virtis®
Bridge Load Rating
Version 6.2.0
Build date Sep 22 2010
Username:
virtis
Password:
Data Source:
Virtis62s_SQLServer
OK
Cancel
Help
Copyright 1997 to 2010 by the American Association of State Highway and Transportation Officials, Inc.
444 North Capitol Street, N.W., Suite 249
Washington, D.C. 20001 U.S.A.
(202) 624-5800

## CREATING A NEW BRIDGE


Bridge Explorer (68 Virtis bridges retrieved for the current folder, all rows retrieved)
All Bridges
LOA
LOA
LOA
Deleted
New
Import...
Folder Properties...
Rate
Report Tool
Bridge Exchange
New Folder
New Bridge
BID
Bridge Id
Bridge Name
District
County
Facility
1 TrainingBridge1 Training Brid 11 01 SR 0051
2 TrainingBridge2 Training Brid -1 -1 N/A
3 TrainingBridge3 Training Brid 11 01 I-79
4 PCITrainingBridge1 PCI TrainingB
5 PCITrainingBridge2 PCITrainingBr
6 PCITrainingBridge3 PCI TrainingB
7 PCITrainingBridge4 PCITrainingBr
8 PCITrainingBridge5 PCI TrainingB
9 PCITrainingBridge6 PCITrainingBr
10 Example7 Example 7 P
11 RCTrainingBridge1 RC Training
12 TimberTrainingBridge1 Timber Tr. Bri
13 FSys GFS TrainingBridge1 FloorSystem 06 15 NJ-Turnpike
14 FSys FS TrainingBridge2 FloorSystem 11 333 I-95
15 FSys GF TrainingBridge3 FloorSystem 07 06 I-95
16 FLine GFS TrainingBridge1 FloorLine GF 01 01 I-75
17 FLine FS TrainingBridge2 FloorLine FS 02 02 I-75
18 FLine GF TrainingBridge3 FloorLine GF 01 01 I-95
19 TrussTrainingExample Truss Trainin
20 LRFD Substructure Example 1 LRFD Substr
21 LRFD Substructure Example 2 LRFD Substr SR 4034
22 LRFD Substructure Example 3 LRFD Substr
23 LRFD Substructure Example 4 LRFD Substr
24 Visual Reference 1 Visual Refer 01 12 I-76
25 06070 06070 04 053 Wheeler's Po
26 06035 06035 04 053 Halligan Park
28 05234 05234 04 041 Route 604 Wi
30 02967 02967 01 021 South Scenic

To create a new bridge right click on the folder where you want to save the bridge and choose New → New Bridge.



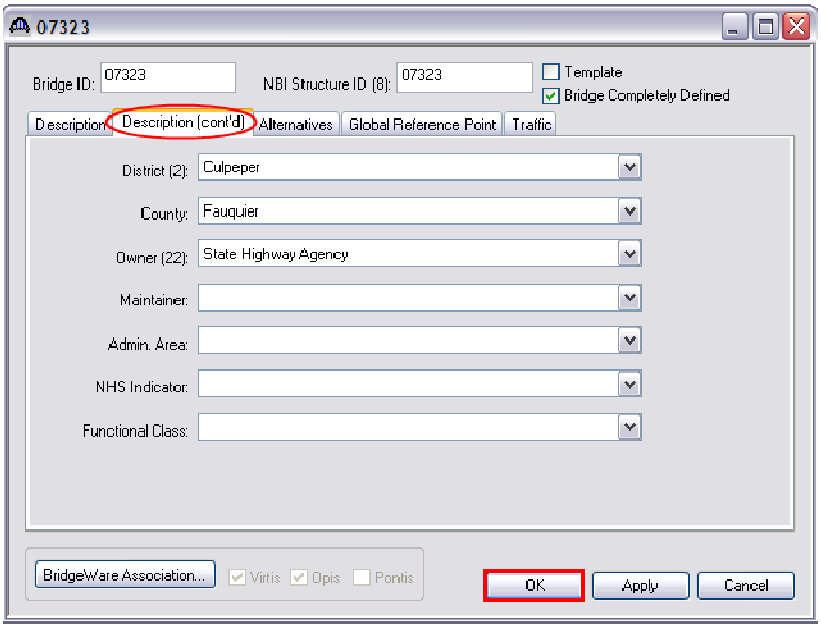

A new window will appear. Fill in the fields as appropriate under the **Description** tab:

**Note:** The description box is a good place to show the plan number used to analyze the structure.

**Template:** Template bridges serve as templates to help develop other bridges.

**Bridge Completely Defined:** Check the box if the specified bridge is completely defined within the Virtis/Opis database. Do not check this box if some of the structures making up the bridge are not in the database.

**BridgeWare Association Button:** Opens the BridgeWare Association window allowing you to specify this current bridge as a Virtis, Opis or Virtis/Opis bridge and also to link this current bridge to a bridge in the Pontis database if Pontis is installed.




**Description (cont'd)** tab: Fill in fields as appropriate.

No input required for the **Alternatives**, **Global Reference Point, and Traffic** tabs. Note that the Traffic tab requires input for a LRFR rating. However, current Virtis capability does not include LRFR rating for trusses and no input is required. Left click **OK** to accept and close.

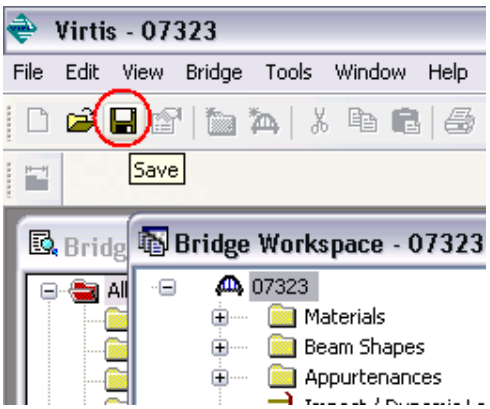
For all Windows:

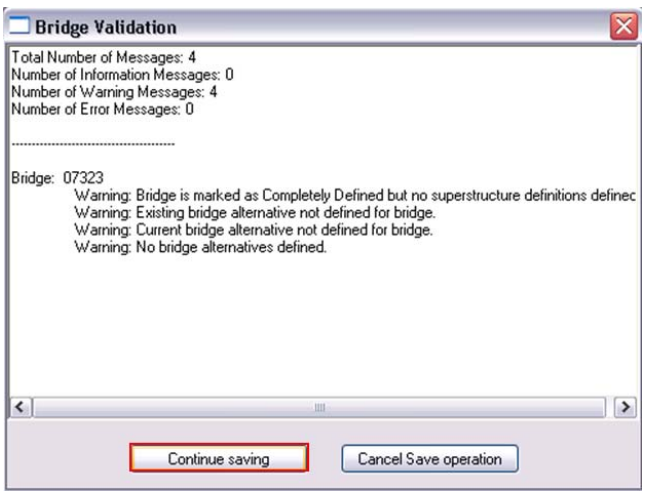
**OK button:** Saves the bridge description in this window and its tabs to memory and closes the window.

**Apply button:** Saves the bridge description in this window and its tabs to memory and keeps the window open.

**Cancel button:** Closes the window without saving the bridge description in this window and its tabs to memory.

**NOTE:** It is strongly recommended that the user save the bridge data at this time. In addition, the user should routinely save the bridge data during the input process.



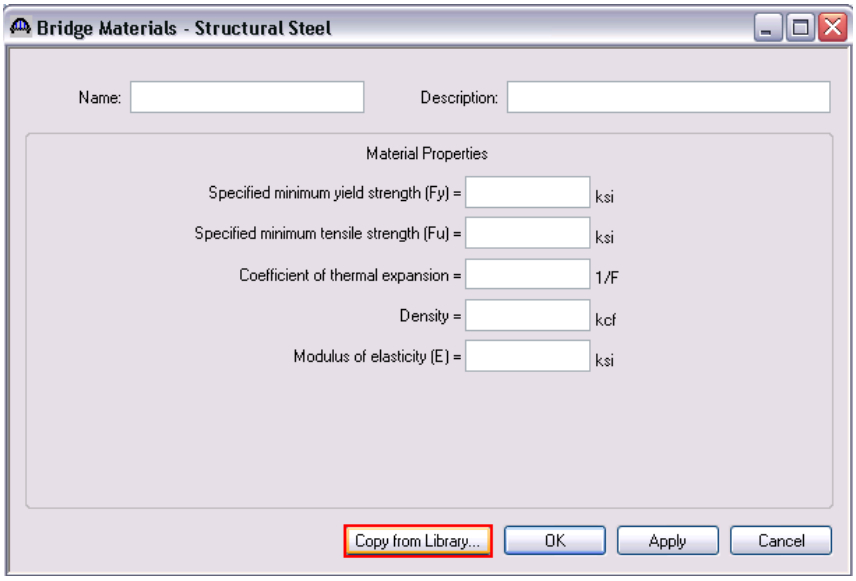


Bridge Validation
Total Number of Messages: 4
Number of Information Messages: 0
Number of Warning Messages: 4
Number of Error Messages: 0
Bridge: 07323
Warning: Bridge is marked as Completely Defined but no superstructure definitions definec
Warning: Existing bridge alternative not defined for bridge.
Warning: Current bridge alternative not defined for bridge.
Warning: No bridge alternatives defined.
Continue saving
Cancel Save operation

Left click the **Save** icon and the **Bridge Validation** window will appear. Left click **Continue Saving** to finish the save process.

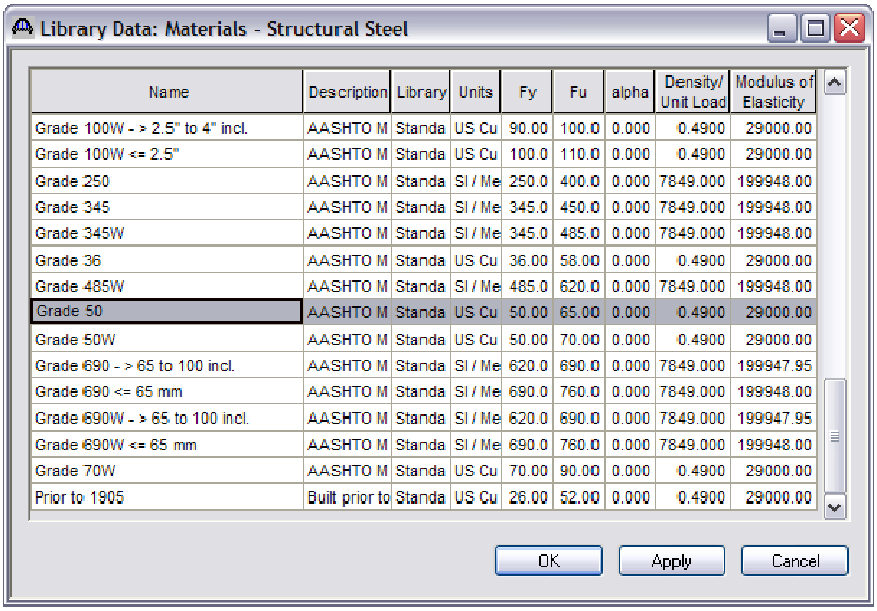
## SELECTING MATERIAL PROPERTIES

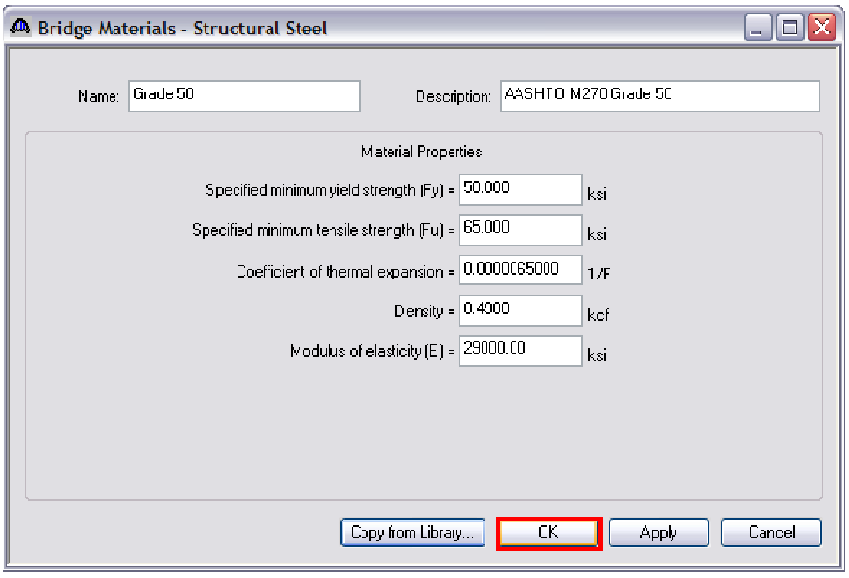
Expand the **Materials** folder.

Double click **Structural Steel** to open the **Bridge Materials – Steel** Window.



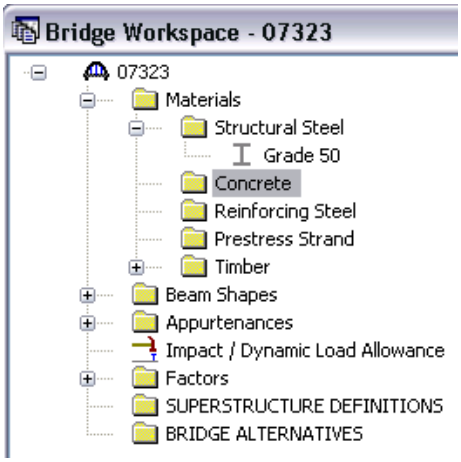

**Copy from Library Button:** Opens the Library - Materials – Structural Steel window, allowing you to copy a set of structural steel material properties from the library to this window.




Bridge Materials - Structural Steel
Name: Grade 50
Description: AASHTO M270 Grade 50
Material Properties
Specified minimum yield strength (Fy) = 50.000 ksi
Specified minimum tensile strength (Fu) = 65.000 ksi
Coefficient of thermal expansion = 0.0000065000 1/F
Density = 0.4900 kcf
Modulus of elasticity (E) = 29000.00 ksi
Copy from Library...
OK
Apply
Cancel

Left click the appropriate structural steel properties and left click the **OK** Button to accept.

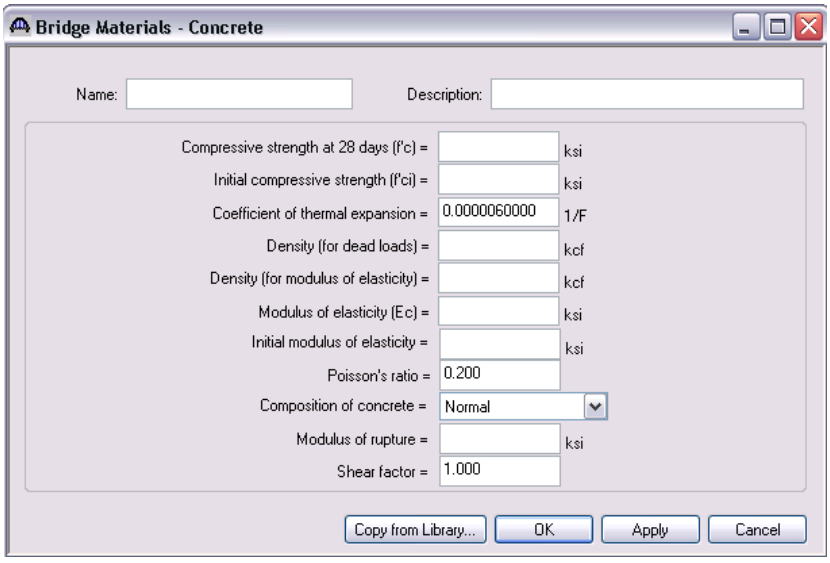
Left click **OK** to accept and close.

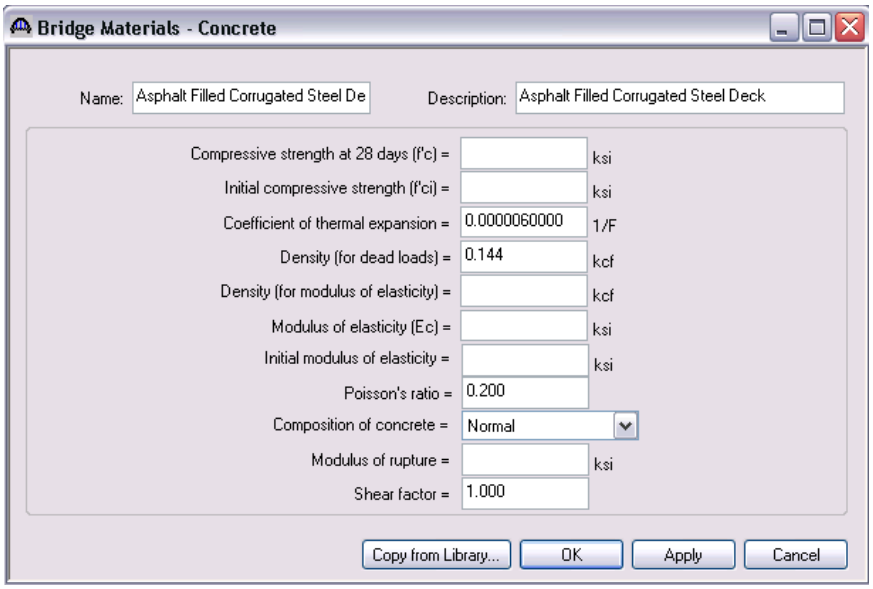



Repeat the process for **Concrete**.

Double click **Concrete** to open the **Bridge Materials – Concrete** Window.

Since the deck is a corrugated steel floor with asphalt surfacing and is non-composite with the stringers, only the density of the concrete for dead loads is needed.


Bridge Materials - Concrete
Name:
Description:
Compressive strength at 28 days (f'c) = ksi
Initial compressive strength (f'ci) = ksi
Coefficient of thermal expansion = 0.0000060000 1/F
Density (for dead loads) = kcf
Density (for modulus of elasticity) = kcf
Modulus of elasticity (Ec) = ksi
Initial modulus of elasticity = ksi
Poisson's ratio = 0.200
Composition of concrete = Normal
Modulus of rupture = ksi
Shear factor = 1.000
Copy from Library...
OK
Apply
Cancel


Bridge Materials - Concrete
Name: Asphalt Filled Corrugated Steel De
Description: Asphalt Filled Corrugated Steel Deck
Compressive strength at 28 days (f'c) =
Initial compressive strength (f'ci) =
Coefficient of thermal expansion = 0.0000060000 1/F
Density (for dead loads) = 0.144 kcf
Density (for modulus of elasticity) =
Modulus of elasticity (Ec) =
Initial modulus of elasticity =
Poisson's ratio = 0.200
Composition of concrete = Normal
Modulus of rupture =
Shear factor = 1.000
ksi
Copy from Library...
OK
Apply
Cancel

**Name:** Asphalt Filled Corrugated Steel Deck

**Description:** Asphalt Filled Corrugated Steel Deck

**Density (for Dead Loads):** 0.1442 kcf (see calculation below).

Left click **OK** to accept and close.

## STEEEL FLOOR WITH ASPHALT SURFACING

### Calculation of Self Weight of Timber Deck

| | | | |
|---|---|---|---|
| Length = | 98.00 | ft | |
| Deck Width = | 13.58 | ft | *Includes deck extending beneath barriers* |
| SIP Weight = | 15.00 | psf | *Sheet 2 of 8, Plan 286-07* |
| Asphalt Surfacing Weight = | 50.00 | psf | *Sheet 2 of 8, Plan 286-08* |
| Total Weight = | 86.53 | kips | |

### Calculation of Self Weight of Deck (Equivalent)

*(Based on deck definition in VIRTIS)*

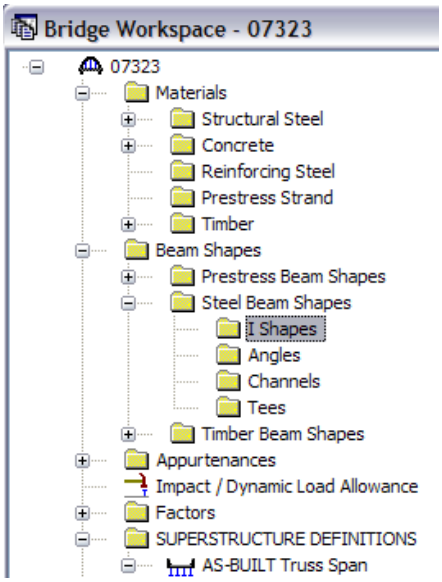
*Concrete Deck*

| | | | |
|---|---|---|---|
| Deck Thickness = | 5.375 | in | |
| Width of Deck = | 13.583 | ft | *Includes deck extending beneath barriers* |
| Length of Bridge = | 98.000 | ft | |
| Total Deck Volume = | 596.252 | $ft^3$ | |
| Total Weight = | 90.000 | kips | *If a solid steel / asphalt deck was used* |

Equivalent Unit Weight = ( 87kips / 90kips ) * 0.15 kcf

**Equivalent Unit Weight = 0.144 kcf** *For input into VIRTIS for unit weight of deck material*

## DEFINING BEAM SHAPES

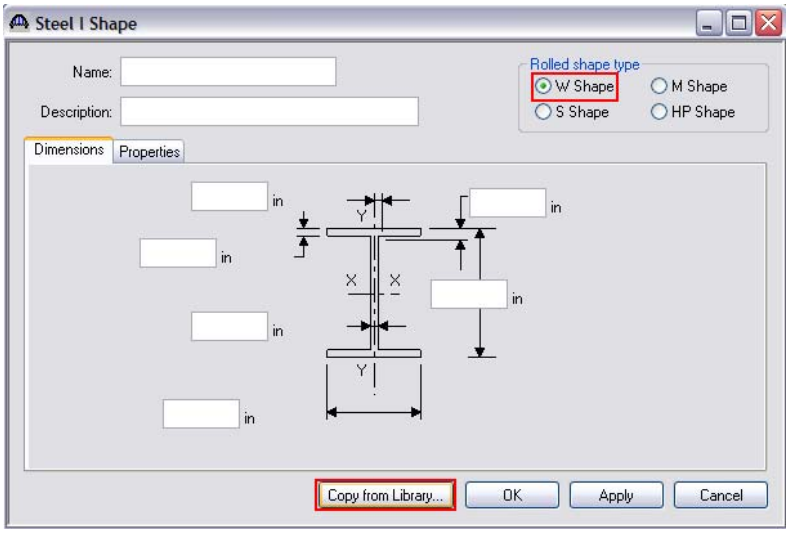



Expand the **Beam Shapes** folder and the **Steel Beam Shapes** folder.

Double click the **I Shapes** folder to create a new beam definition.

The following I shapes will be added:

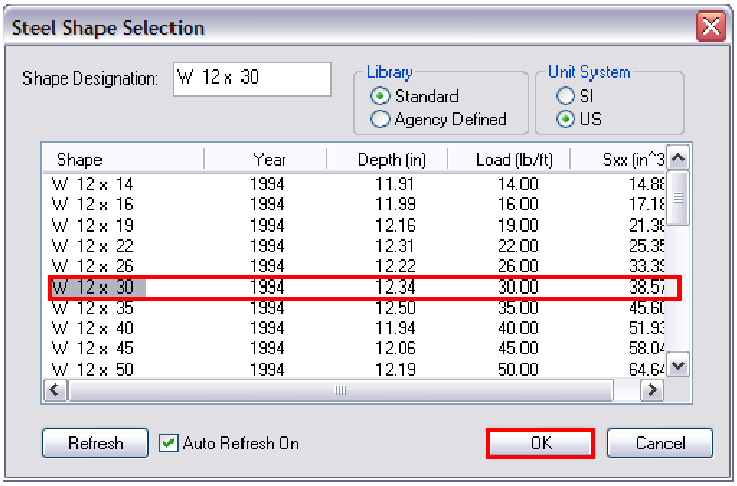
1. W 12x30
2. W 18x55
3. W 12x50
4. W 12x26



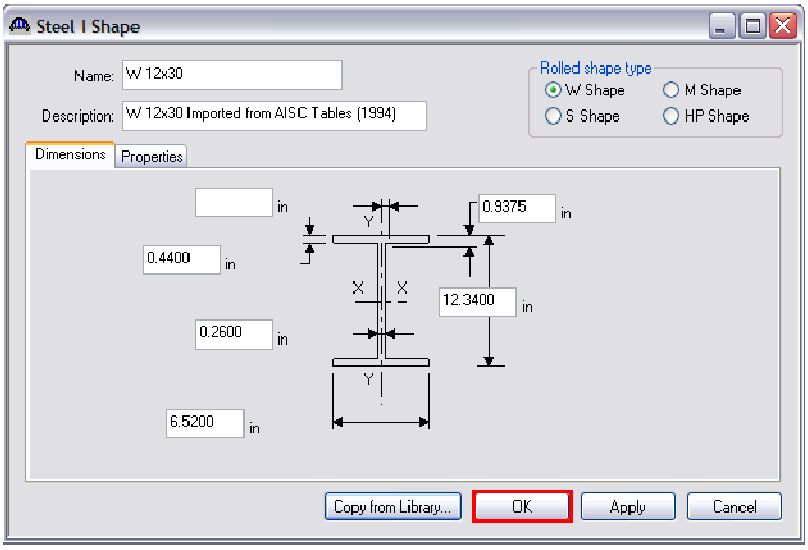

The **Steel I Shape** window will open

Select **W Shape** as the **Rolled Shape Type**.

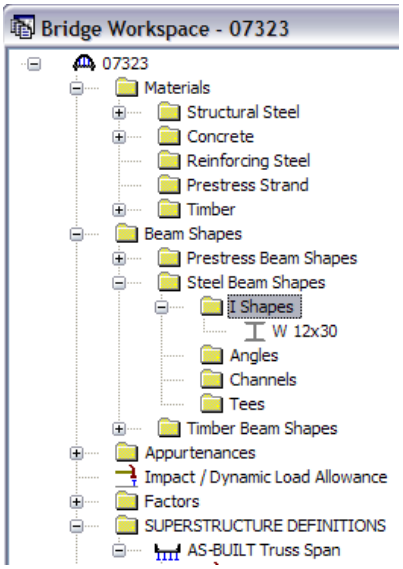
Left click the **Copy from Library…** window.



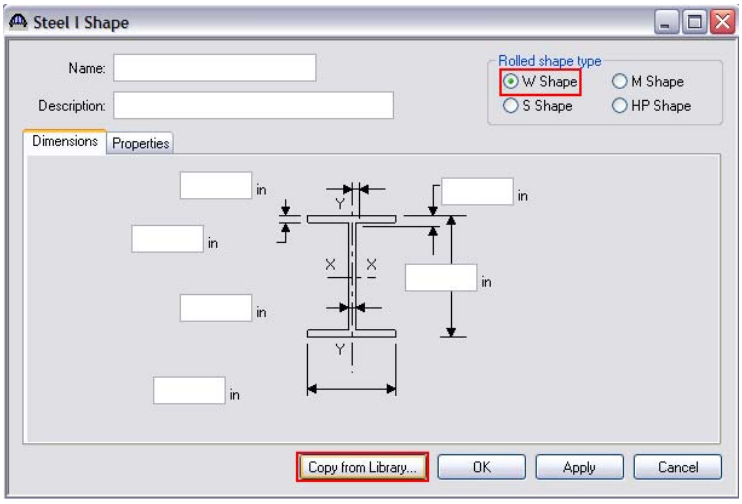

Select **W12x30**, which will be used for the stringers, and left click **OK** to accept and close.




Left click **OK** to accept and close.



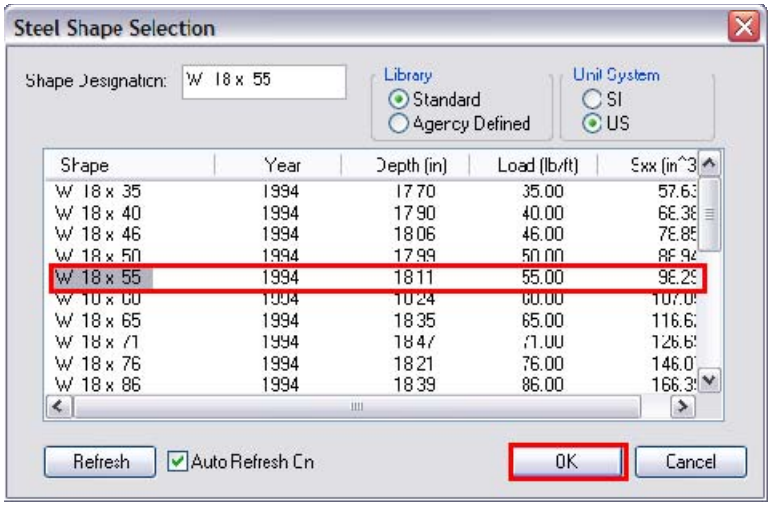

Double click the **I Shapes** folder to create a new beam definition.



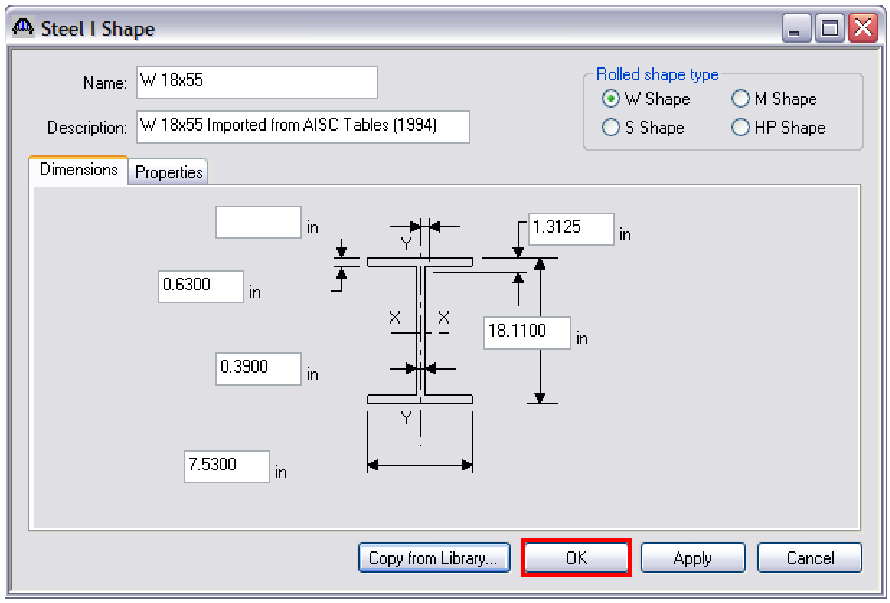

The **Steel I Shape** window will open.

Select **W Shape** as the **Rolled Shape Type**.

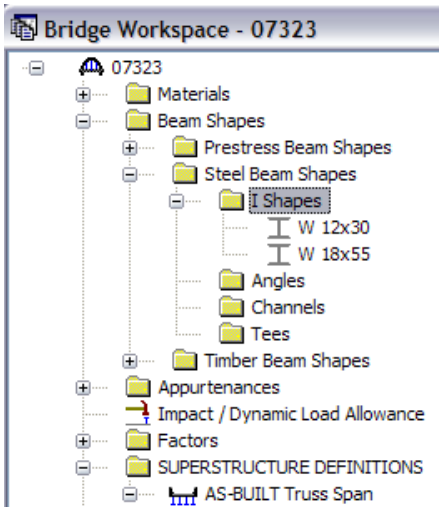
Left click the **Copy from Library…** window.




Select **W18x55**, which will be used for the floorbeams, and left click **OK** to accept and close.

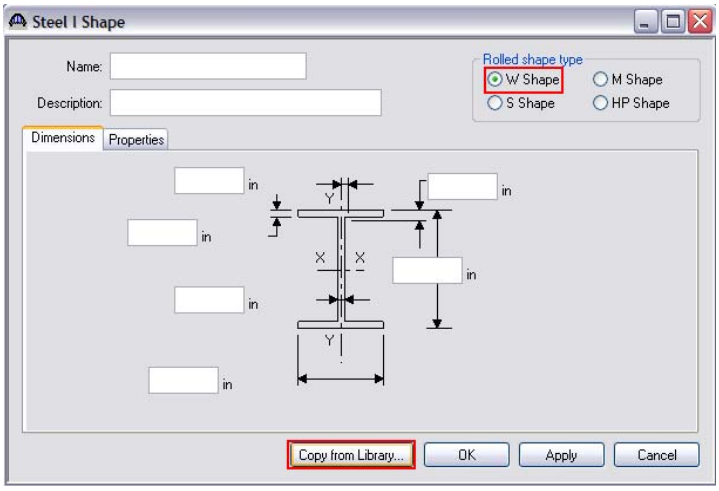



Left click **OK** to accept and close.



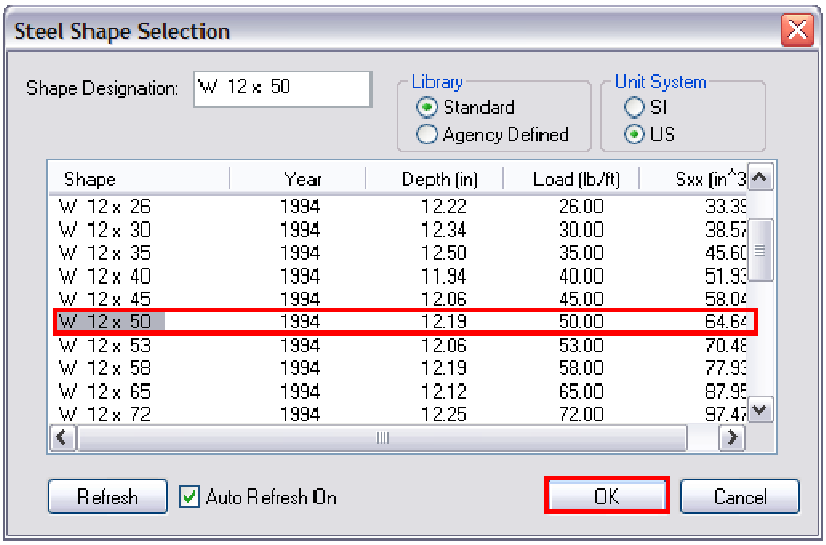

Double click the **I Shapes** folder to create a new beam definition.

The **Steel I Shape** window will open.

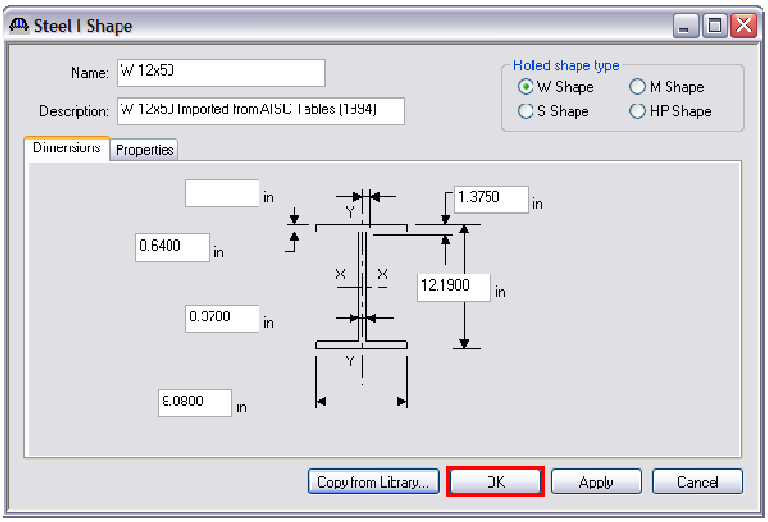



Select **W Shape** as the **Rolled Shape Type**.

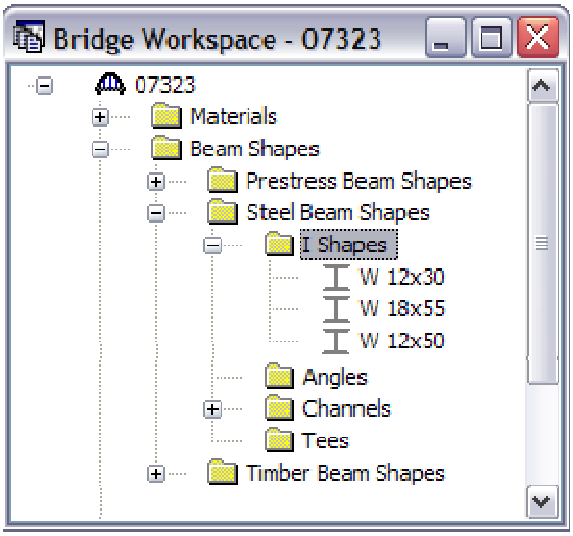
Left click the **Copy from Library…** window.



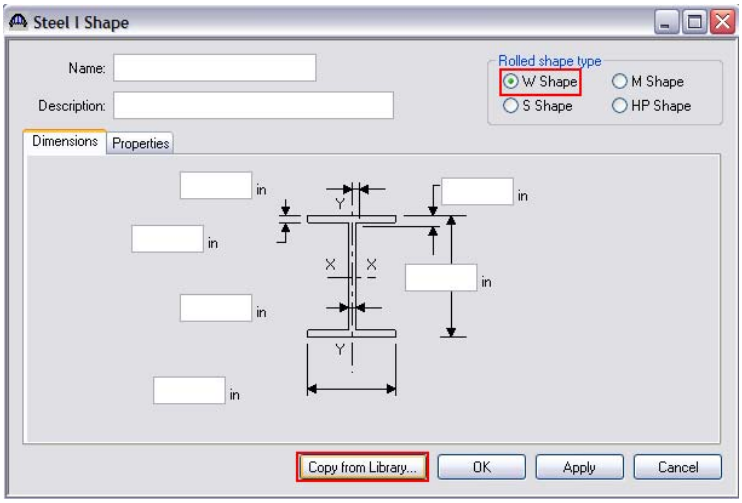

Select **W12x50**, which will be used for truss members, and left click **OK** to accept and close.




Left click **OK** to accept and close.



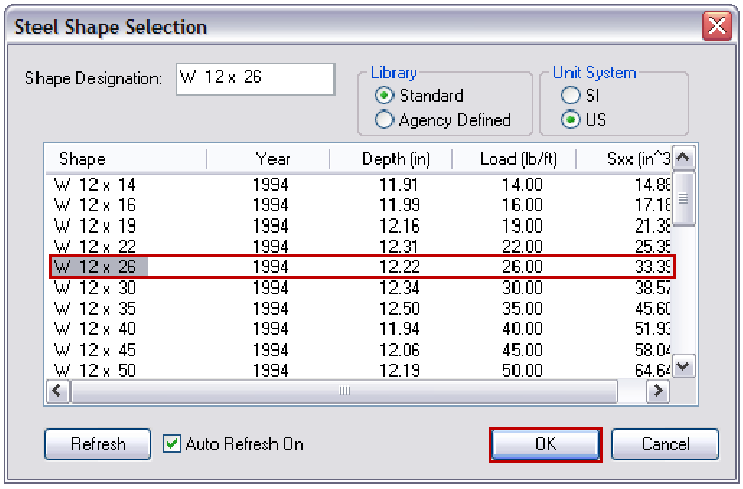

Double click the **I Shapes** folder to create a new beam definition.



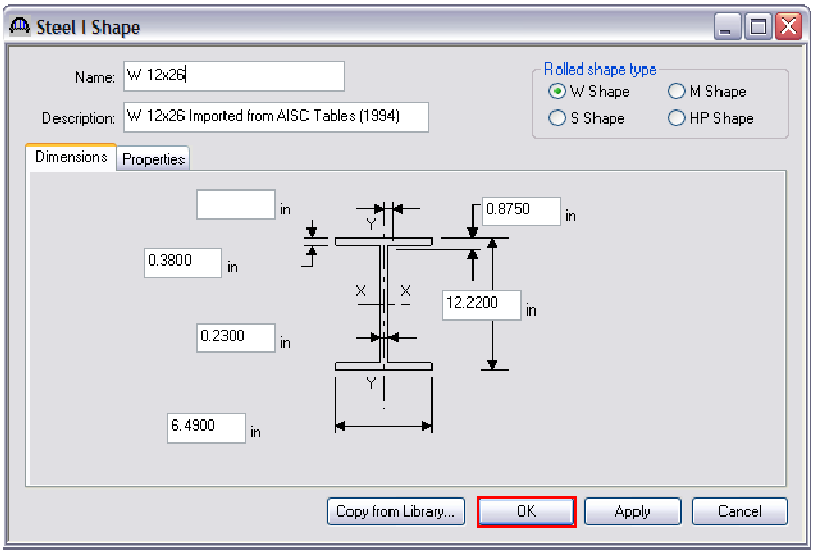

The **Steel I Shape** window will open.

Select **W Shape** as the **Rolled Shape Type**.

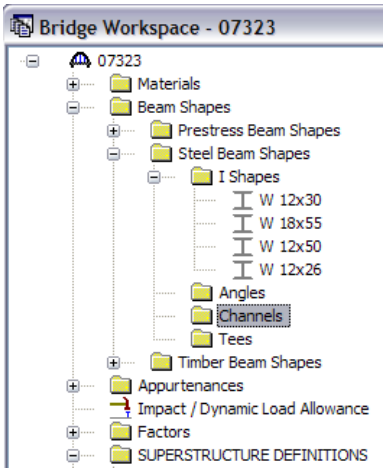
Left click the **Copy from Library…** window.



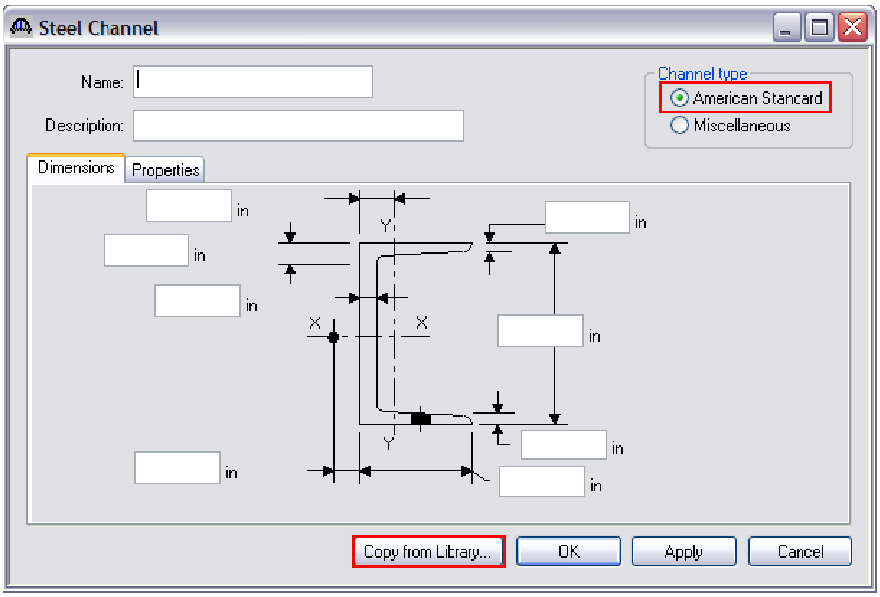

Select **W12x26**, which will be used for truss members, and left click **OK** to accept and close.




Left click **OK** to accept and close.



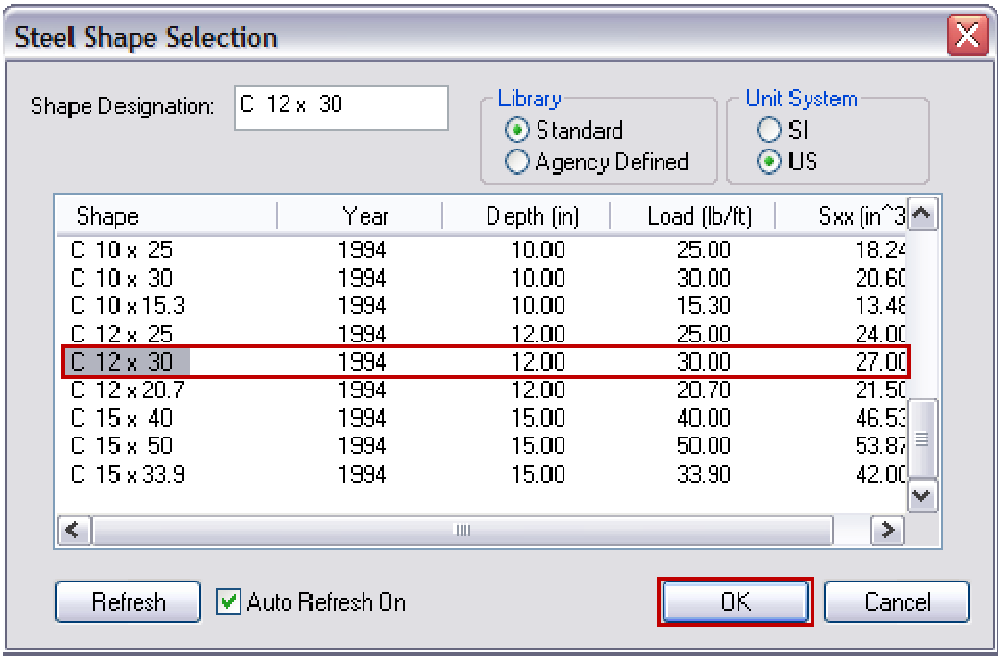

Double click the **Channels** folder to create a new channel definition.



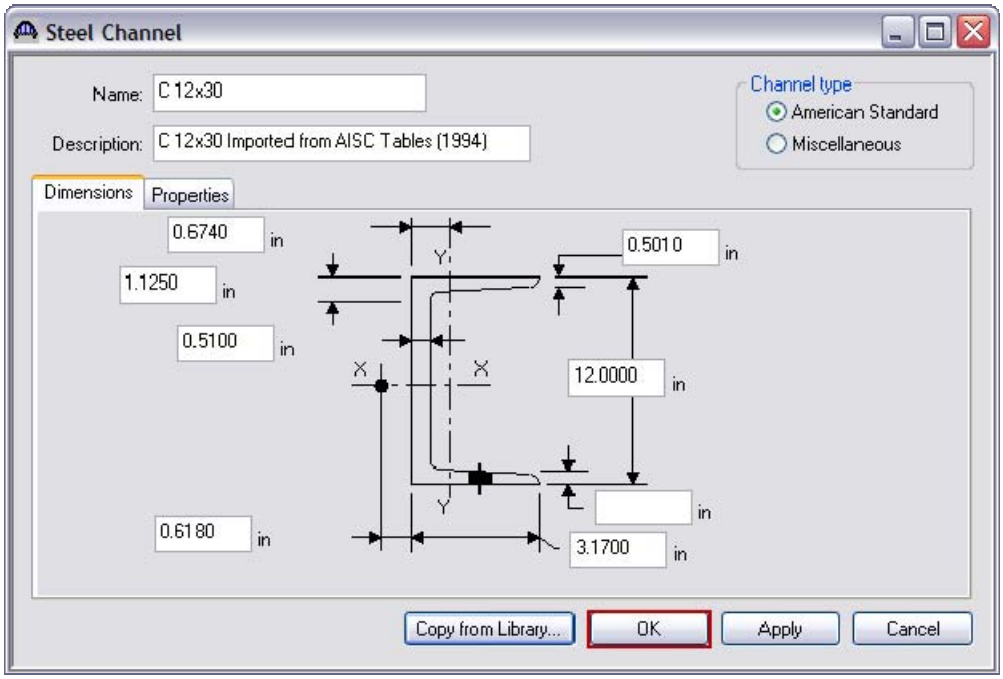

The **Steel Channel** window will open.

Select **American Standard** as the **Channel Type**.

Left click the **Copy from Library…** window.

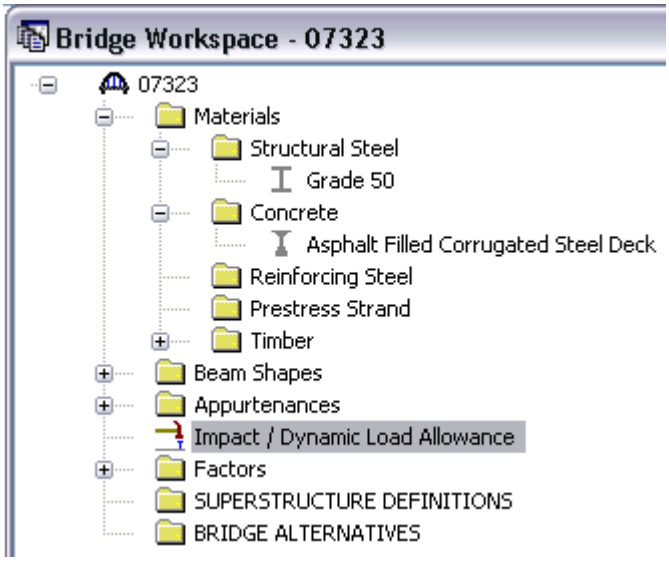



Select **C12x30**, which will be used for truss members, and left click **OK** to accept and close.

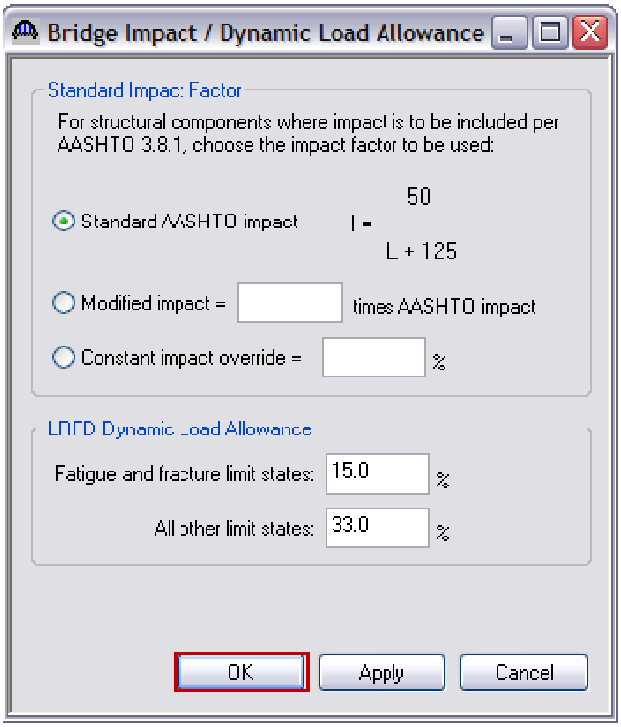



Left click **OK** to accept and close.

## SELECTING IMPACT/DYNAMIC LOAD ALLOWANCES

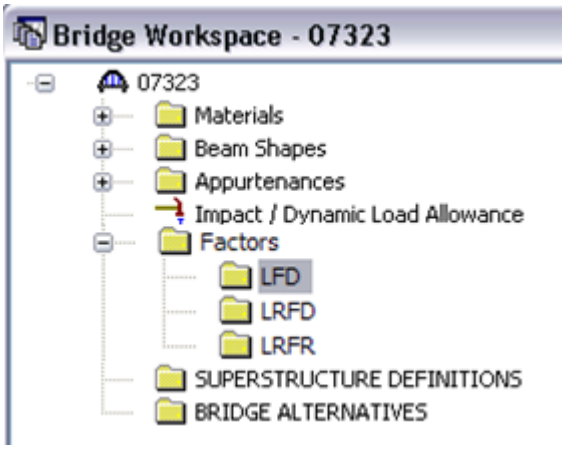



Double click **Impact / Dynamic Load Allowance** to open.



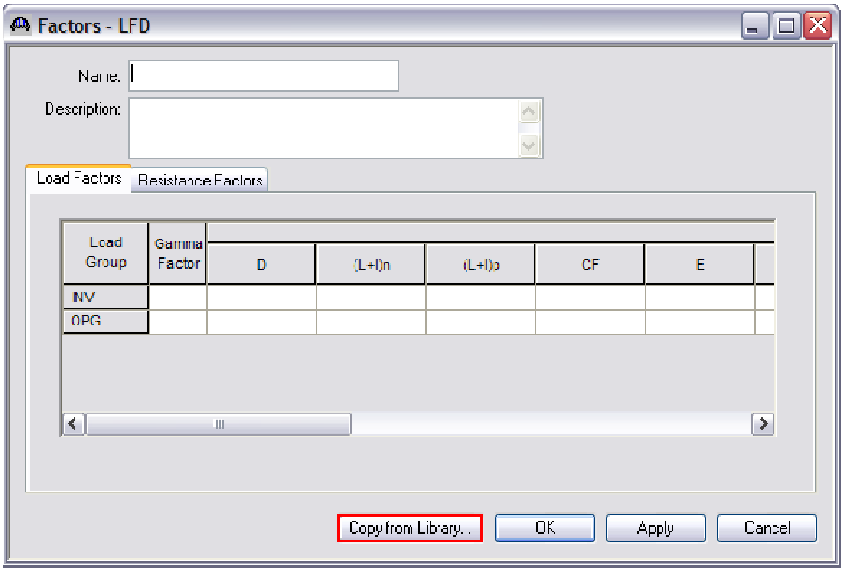

Left click the **OK** button to accept and close.

## SELECTING FACTORS

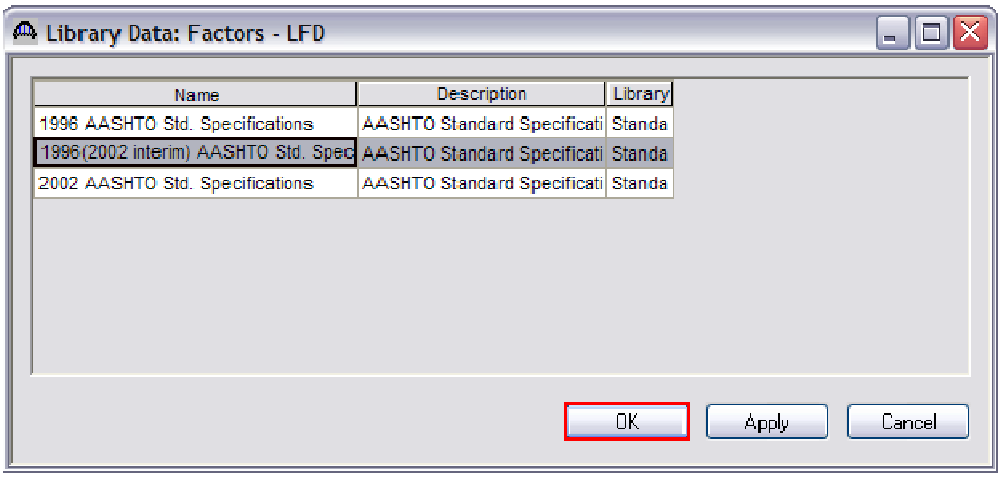



Expand the **Factors** folder.

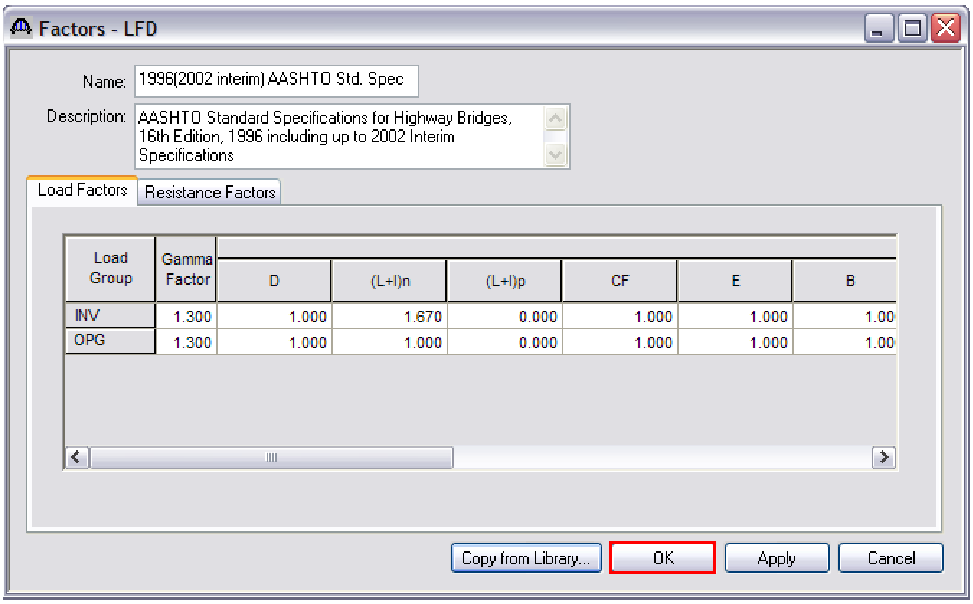
Double click **LFD** to open.




Left click the **Copy from Library…** button to open the library data for LFD factors.

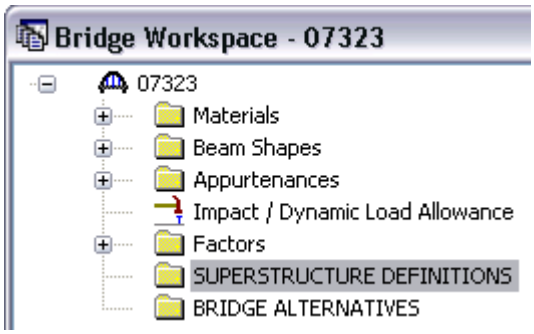



Select the appropriate factors and left click the **OK** button to accept.

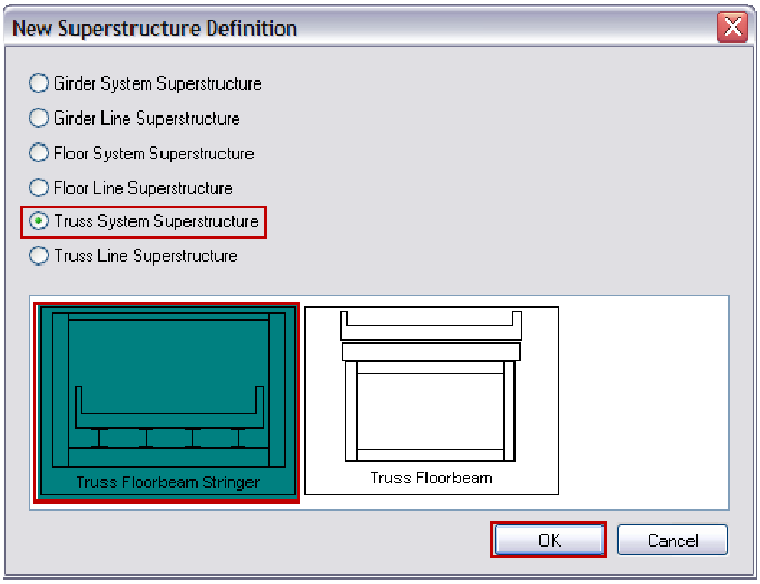



Left click the **OK** button to accept and close.

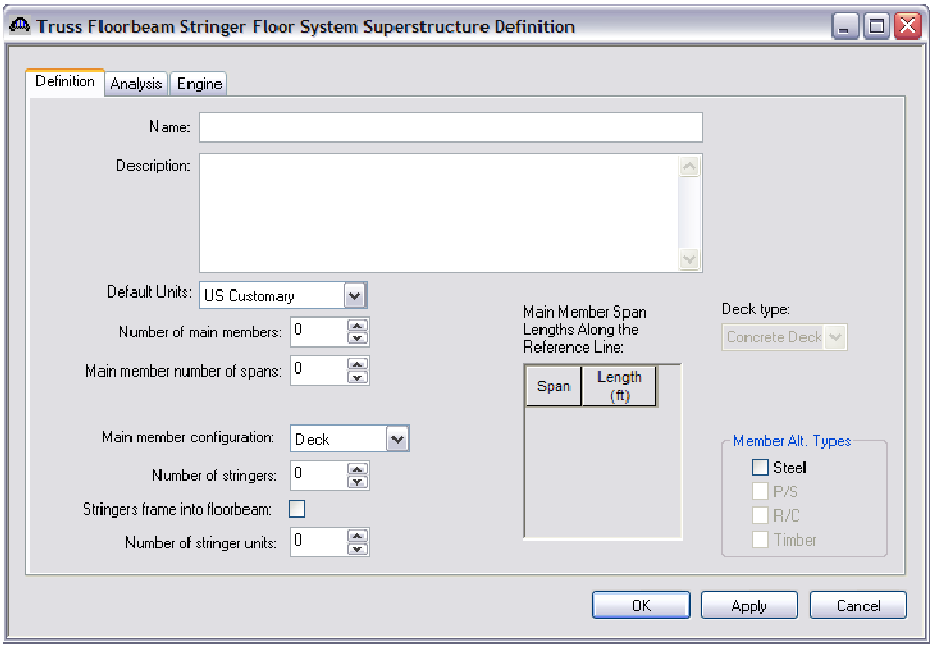
## CREATING SUPERSTRUCTURE DEFINITIONS: TRUSS SPAN

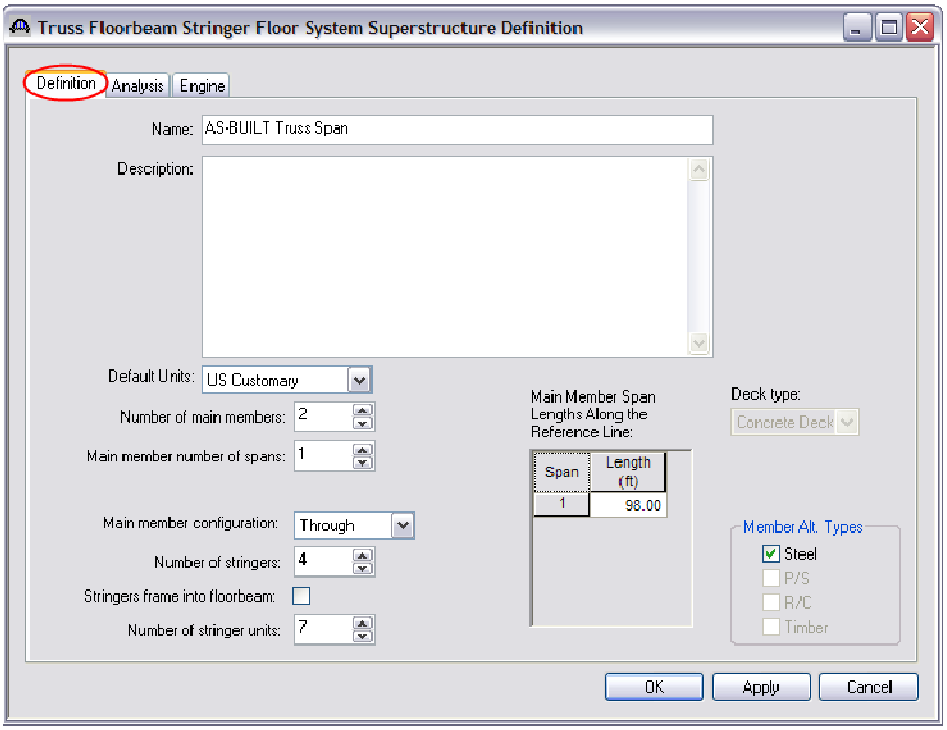



Double click **SUPERSTRUCTURE DEFINITIONS** to open.




Select **Truss System Superstructure** and the **Truss Floorbeam Stringer** figure. Left click the **OK** button to accept and close.






**Definition** Tab:

**Name:** AS-BUILT Truss Span

**Description:** No information required, but user can input additional information or assumptions if desired.

**Default Units:** US Customary

**Number of main members:** 2

**Main member number of spans:** 1

**Main member configuration:** User can select **Deck**, **Half Deck**, or **Through**. For this example, select **Through**.

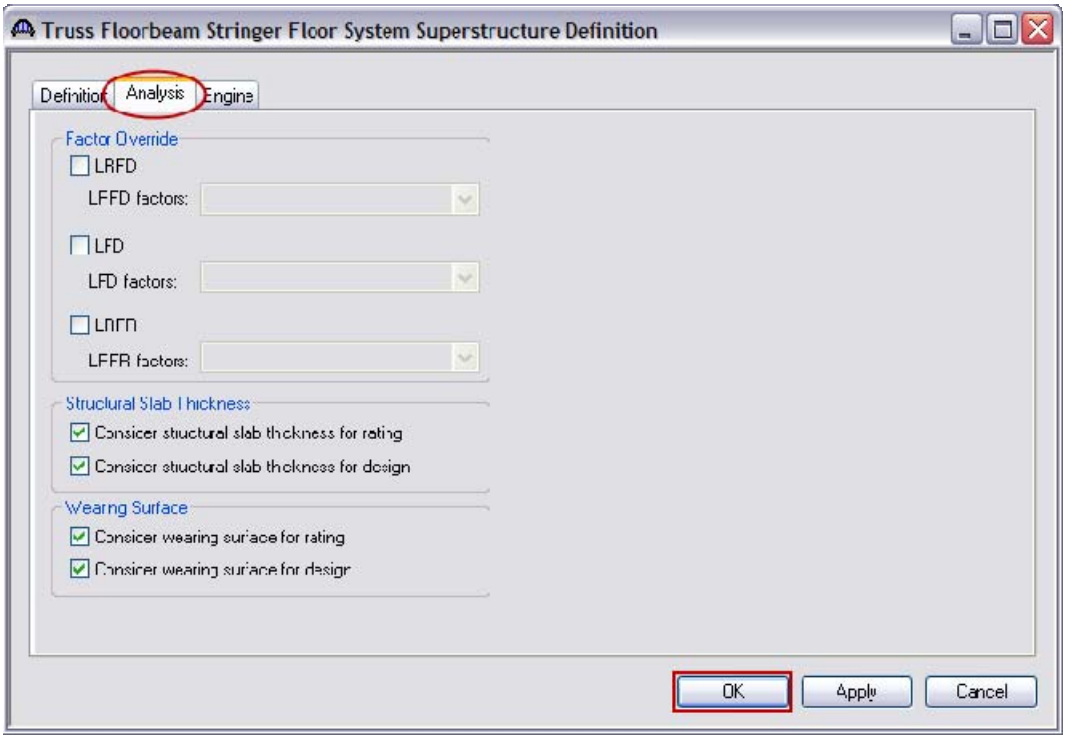
**Number of stringers:** 4

**Stringers frame into floorbeam:** Since the stringers bear on top of the floorbeams, do not check the box.

**Number of stringer units:** 7

**Span Length:** This input is for the centerline of bearing to centerline of bearing distance. Use **98.00** ft for this example.

**Member Alt. Types:** Check the **Steel** box. (Only available option)




**Analysis** Tab:

**Factor Override:** None selected. Factor Override allows you to override the System Defaults library factors with a set of factors that have been entered for this bridge only. Factor overrides will remain when files are imported into future versions of Virtis. Unless factors specific to the bridge are required, overrides are not recommended as they can prevent updates to System Defaults in future versions (e.g., legal load SHV factors in the MBE).

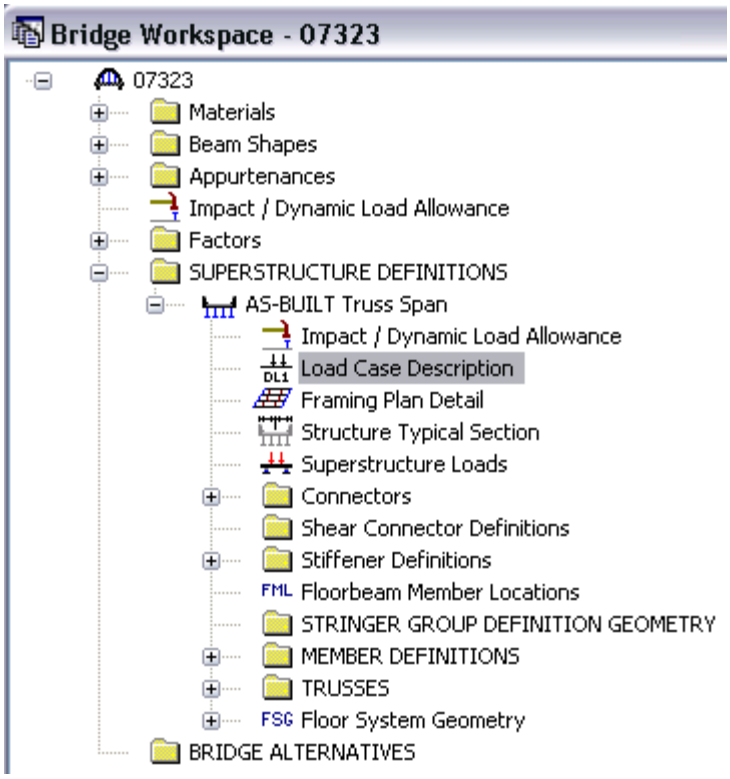
**Consider structural slab thickness for rating/design:** Check this box if the structural slab thickness should be used to compute section properties for rating/design. If this box is not checked, the rating/design will use section properties computed from the total deck thickness.

**Consider wearing surface thickness for rating/design:** Check this box if the wearing surface should be added as a dead load. If this box is not checked, the rating/design will not add the dead load from the wearing surface.

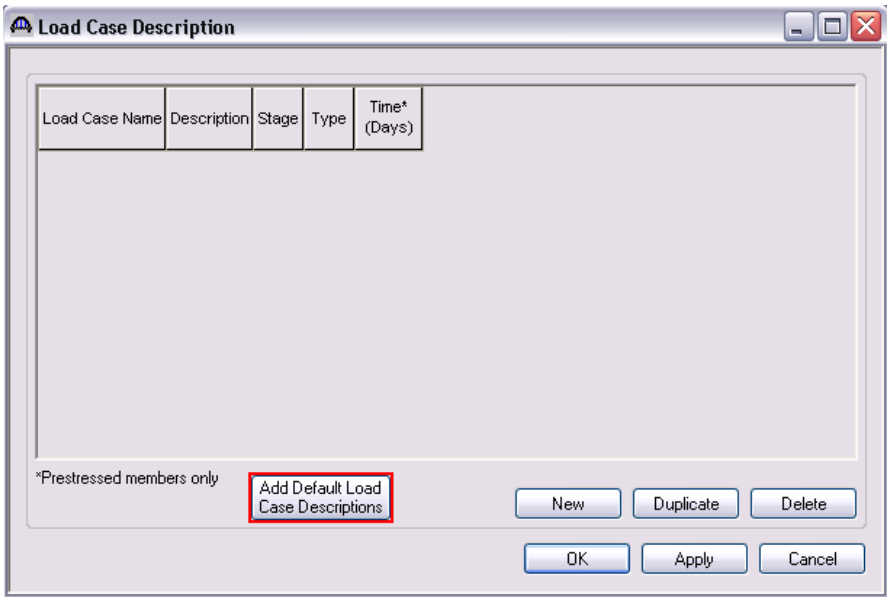
No input required for the **Engine** tab.

Left click **OK** to accept and close.

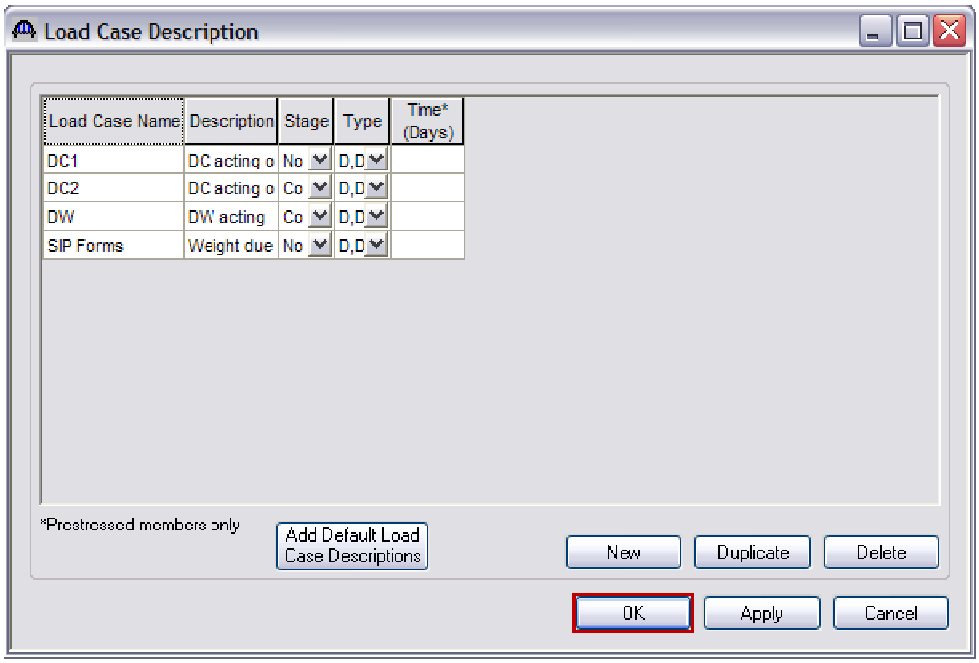
## DEFINING LOAD CASES




Double click **Load Case Description** to open the Load Case Description window.

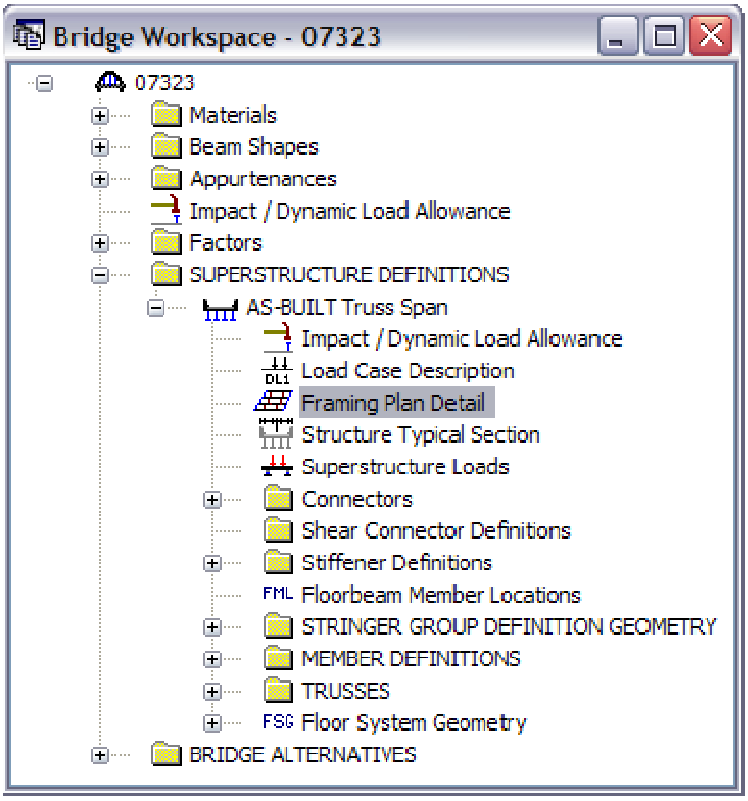



Left click **Add Default Load Case Descriptions** to apply default load cases. The default load cases include dead load (DC1) acting on non-composite section, dead load (DC2) acting on long-term composite section, dead load (DW) acting on long-term composite section and stay-in-place forms acting on non-composite section. These default load cases can be edited and modified as desired.

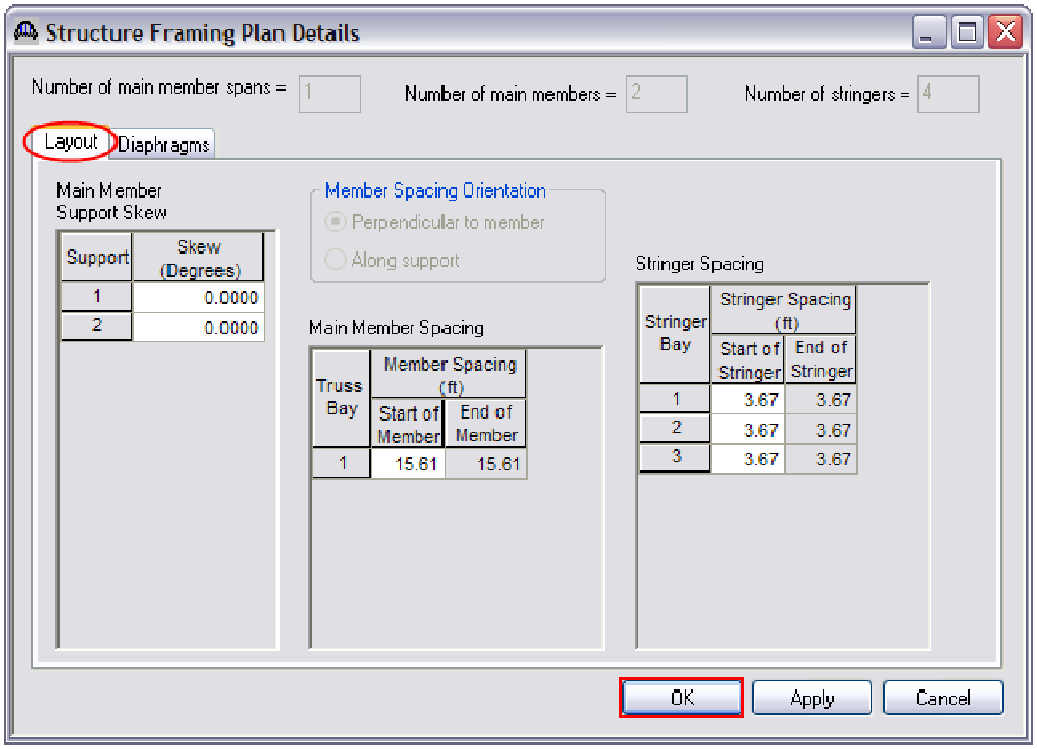



Left click the **OK** button to accept and close.

## FRAMING PLAN DETAIL




Double click **Framing Plan Detail**.




**Layout** Tab:

**Main Member Support Skew**

**Skew:** 0.00º (for both supports)

**Main Member Spacing**

**Member Spacing at Start and End of Member:** This is the input for the centerline of truss to centerline of truss dimension. For this example, input **15.614583** ft. Since the deck is not flared, this value is valid at both the start and end of the bridge.

**Stringer Spacing**

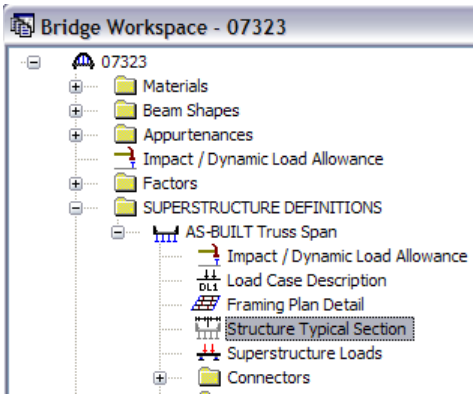
**Stringer Spacing at the Start and End of Stringer:** 3.666667 ft. for each stringer bay. Since the deck is not flared, this value is valid at both the start and end of the bridge.

**Diaphragms Tab:**

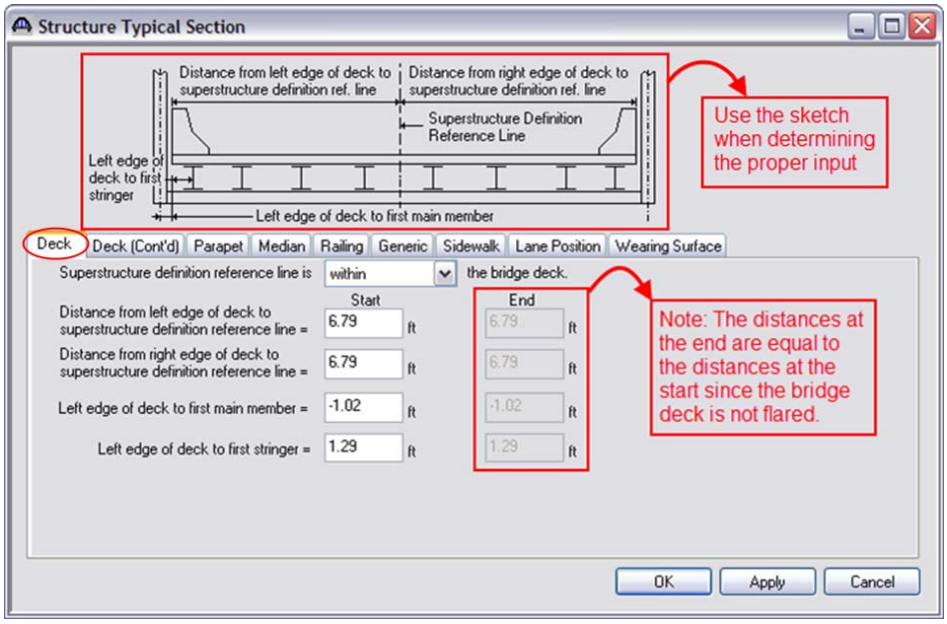
This example does not have diaphragms. Therefore, this tab can be left blank.

Click **OK** to accept and close.

## STRUCTURE TYPICAL SECTION




Double click **Structure Typical Section**.


Structure Typical Section
Distance from left edge of deck to superstructure definition ref. line
Distance from right edge of deck to superstructure definition ref. line
Superstructure Definition Reference Line
Left edge of deck to first stringer
Left edge of deck to first main member
Use the sketch when determining the proper input
Deck
Deck (Cont'd)
Parapet
Median
Railing
Generic
Sidewalk
Lane Position
Wearing Surface
Superstructure definition reference line is
within
the bridge deck.
Start
End
Distance from left edge of deck to superstructure definition reference line =
6.79
ft
Distance from right edge of deck to superstructure definition reference line =
6.79
ft
Left edge of deck to first main member =
-1.02
ft
Left edge of deck to first stringer =
1.29
ft
Note: The distances at the end are equal to the distances at the start since the bridge deck is not flared.
OK
Apply
Cancel

**Deck** Tab:

**Superstructure definition reference line is:** Select **within** the bridge deck from the drop down menu since the superstructure definition reference line is at the centerline of roadway.

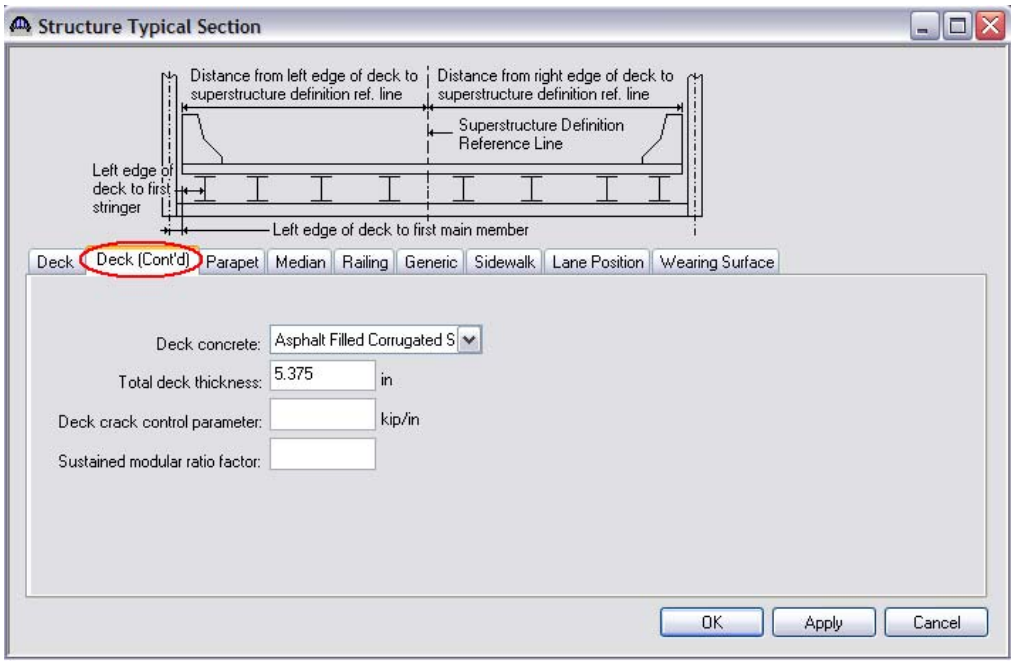
**Distance from the left edge of deck to superstructure definition reference line:** 6.791666 ft. (13.583333 ft / 2)

**Distance from the right edge of deck to superstructure definition reference line:** 6.791666 ft. (13.583333 ft / 2)

**Left edge of deck to first main member:** -1.015625 ft. (This value is negative since the through truss was selected.) (15.6145833 ft – 13.583333 ft ) / 2

**Left edge of deck to first stringer:** 1.291666 ft.
[13.583333 ft – ( 3 spa. * 3.666667 ft)] / 2

**Note:** For this example, six decimal places are used for the input. User can you up to a maximum of 6, but does not have to use that many. However, a consistent amount of decimal places should be used for all input.



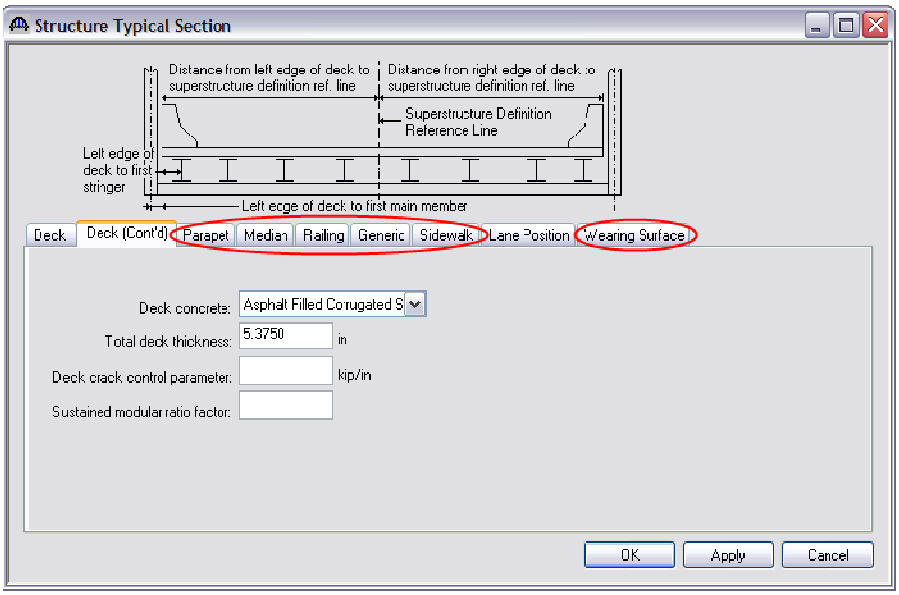

**Deck (Con'd)** Tab:

**Deck concrete:** Select **Asphalt Filled Corrugated Steel Deck** from the drop down menu.

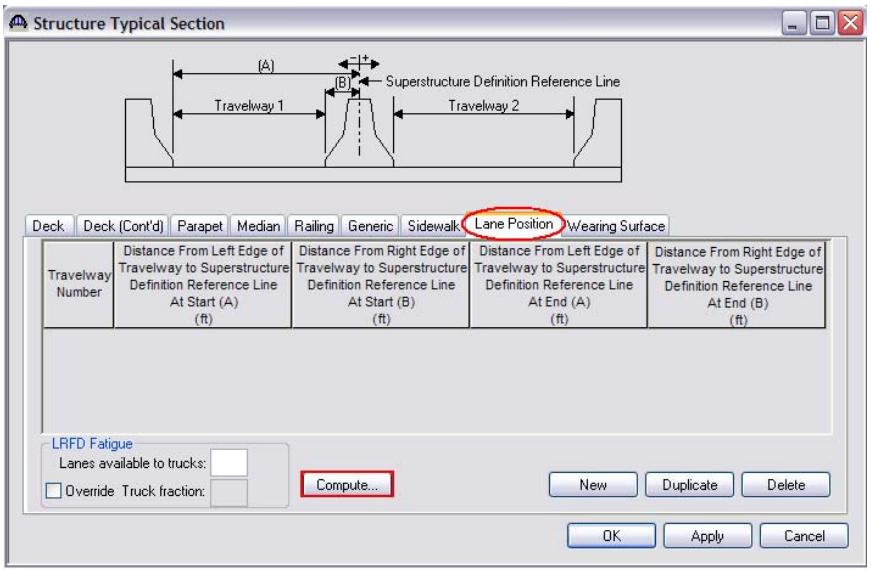
**Total deck thickness:** 5.375 in.

**Deck crack control parameter:** This field can be left blank since the deck is not composite with the stringers and is only used for dead loads calculations.

**Sustained modular ratio factor:** This field can be left blank since the deck is not composite with the stringers and is only used for dead loads calculations.

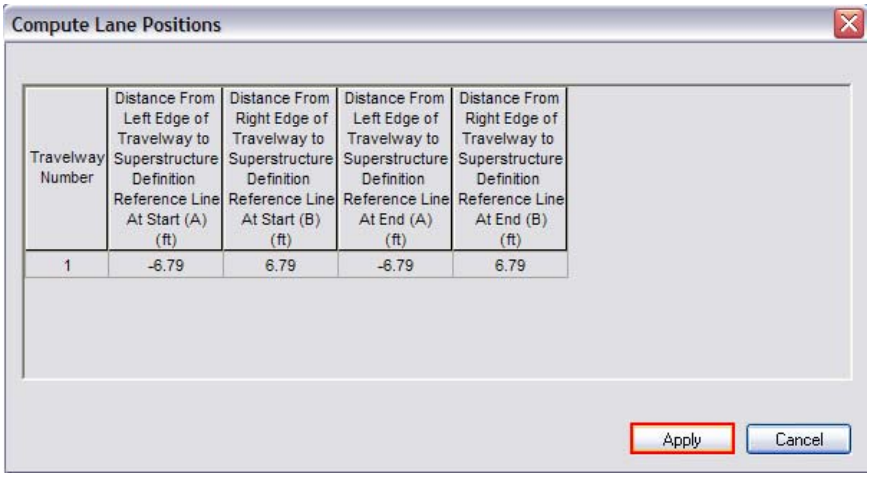



**Note:** Since parapets, median, railings, generic barriers, sidewalks, or a wearing surface is not present on the bridge, input for these tabs is not required.

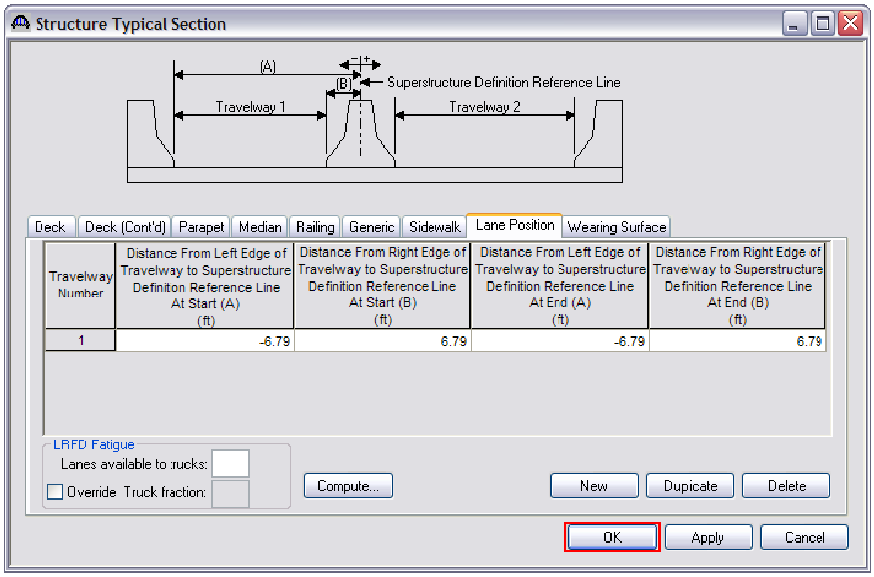



**Lane Position** Tab:

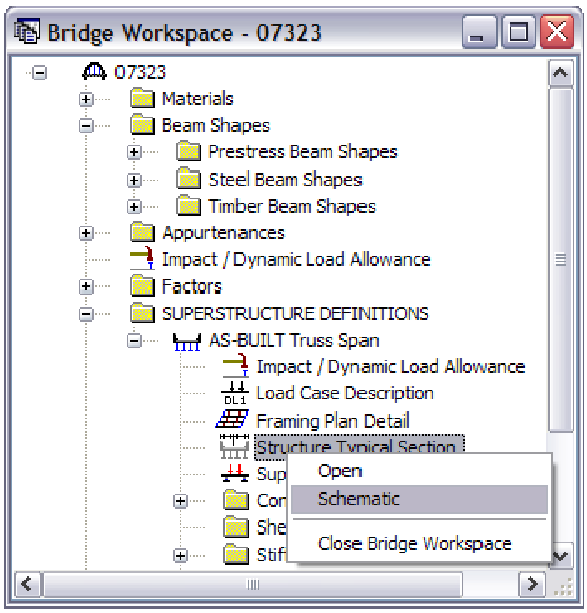
Left click the **Compute…** button.


Compute Lane Positions
Travelway Number
Distance From Left Edge of Travelway to Superstructure Definition Reference Line At Start (A) (ft)
Distance From Right Edge of Travelway to Superstructure Definition Reference Line At Start (B) (ft)
Distance From Left Edge of Travelway to Superstructure Definition Reference Line At End (A) (ft)
Distance From Right Edge of Travelway to Superstructure Definition Reference Line At End (B) (ft)
1
-6.79
6.79
-6.79
6.79
Apply
Cancel

Left click the **Apply** button.

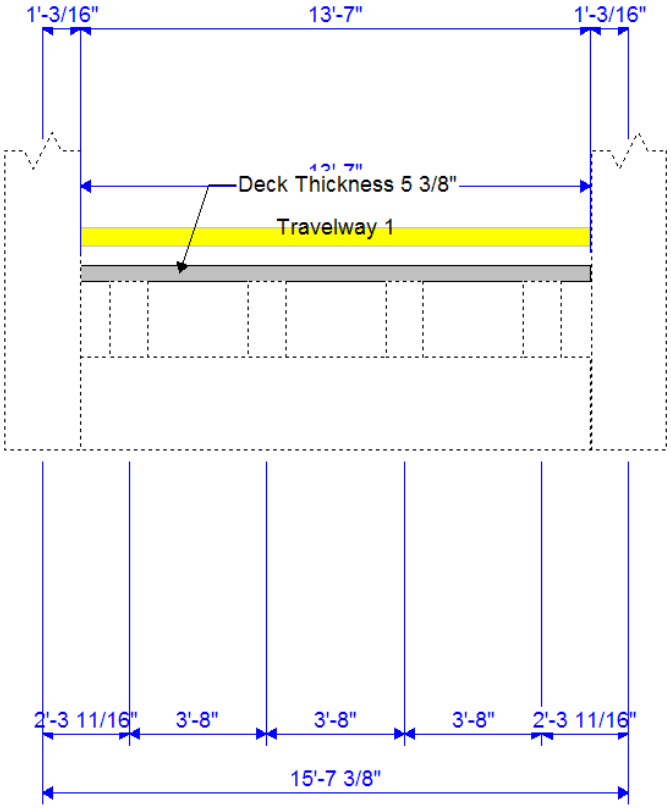



Left click **OK** to accept and close.



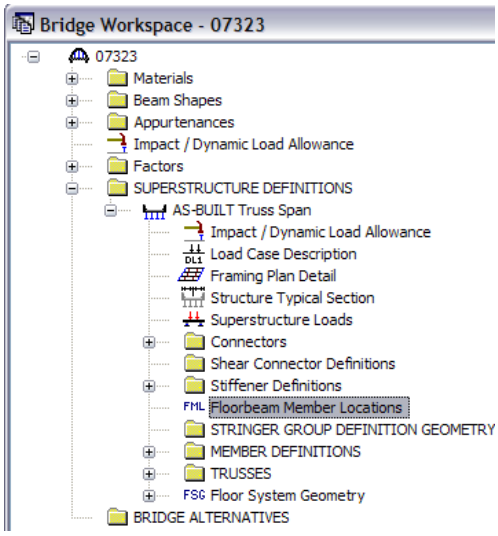

**Note:** User can view a schematic of the typical section by right clicking the **Structure Typical Section** and selecting **Schematic**.

07323
07323 - AS-BUILT Truss Span
Tapps Ford Road / Rappahannock Road
09/22/11

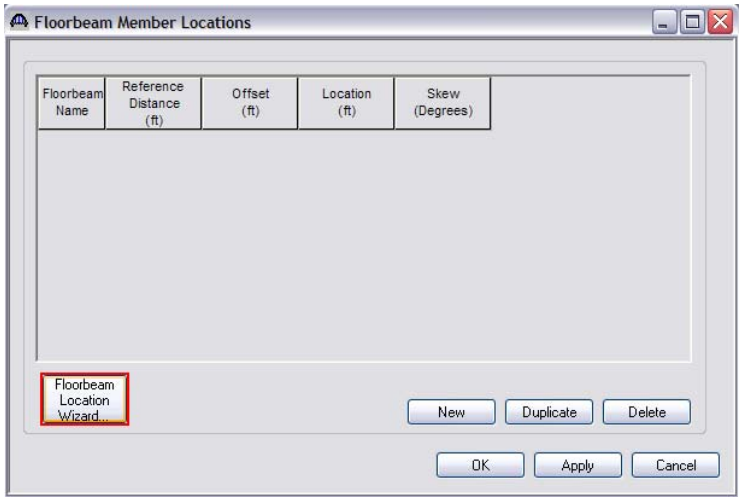



Notes:
* The truss members are not drawn to scale.

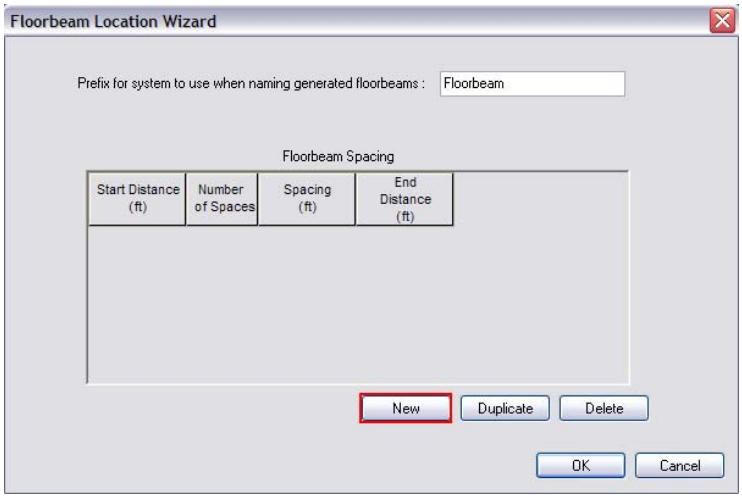
## FLOORBEAM MEMBER LOCATIONS




Double click **Floorbeam Member Locations**.

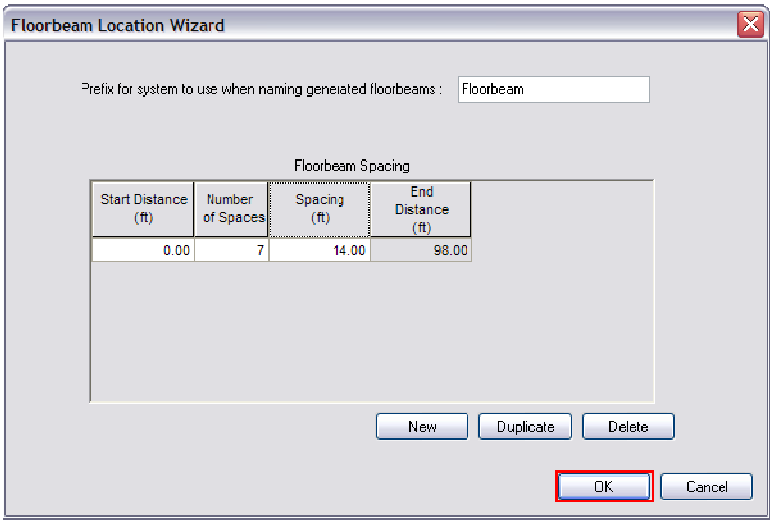



Left click **Floorbeam Location Wizard…**




The **Floorbeam Location Wizard** window will appear.

Left click the **New** button.

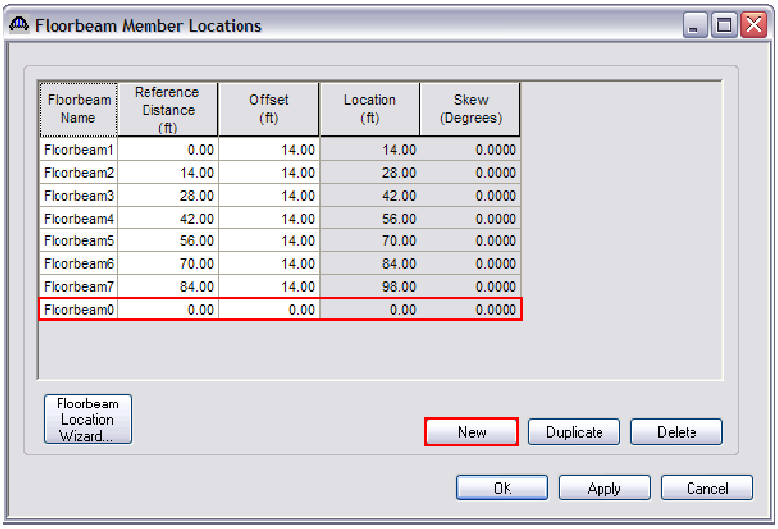



**Start Distance:** 0.00 ft.

**Number of Spaces:** 7

**Spacing:** 14.00 ft.

Left Click **OK** to accept and close.



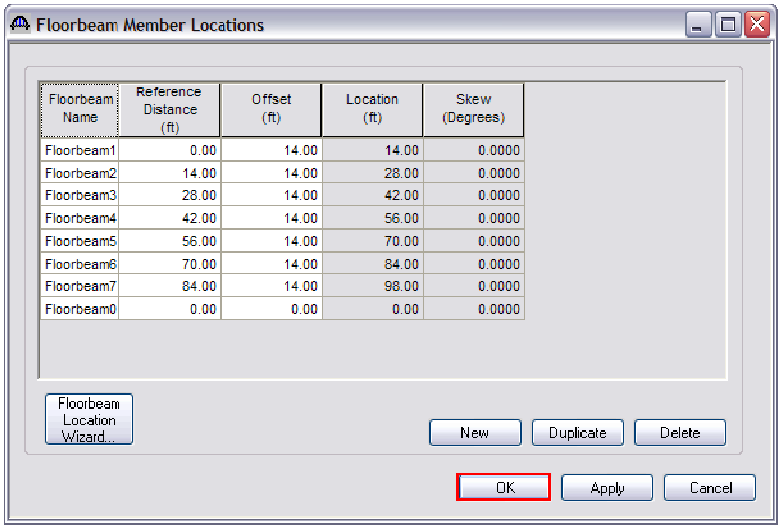

A floorbeam still needs to be placed at the start of the structure. To do this, click the **New** button.

**Floorbeam Name:** Floorbeam0

**Reference Distance:** 0.00 ft

**Offset:** 0.00 ft

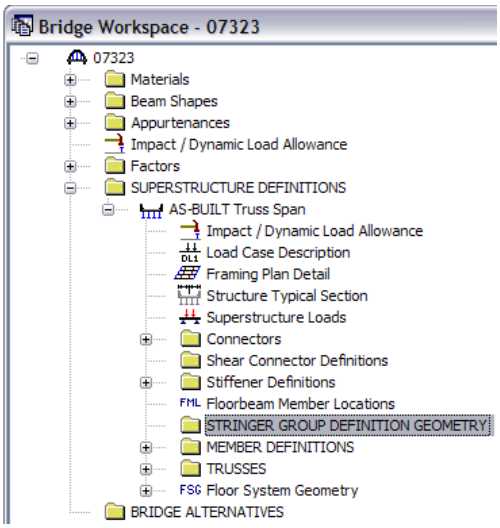
**Note:** The offset is the length between the Reference Distance and the Location.




**Note:** Even though floorbeams are not located at the abutments as shown on the plans, fictitious floorbeams must be placed at the beginning and the end of the structure. If a floorbeam is not defined at each panel point, Virtis cannot analyze the bridge.

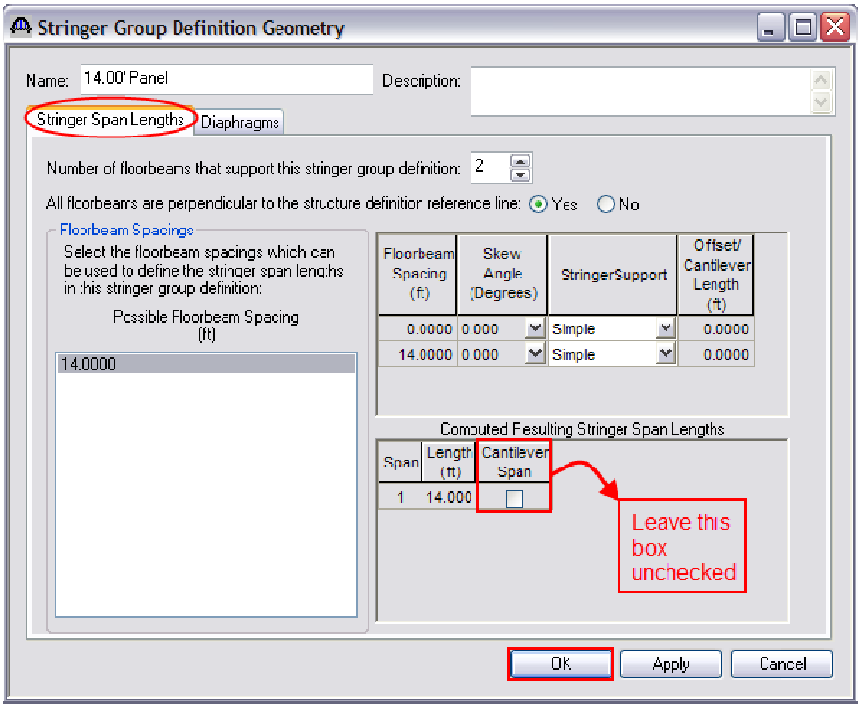
Left click **OK** to accept and close.

## STRINGER GROUP DEFINITION GEOMETRY




This window allows the user to define how many floorbeams support a stringer group and the type of support between the stringers and the floorbeam.

Double click **STRINGER GROUP DEFINITION GEOMETRY**.




**Stringer Span Lengths** Tab:

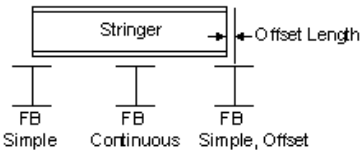
**Name:** 14.00' Panel

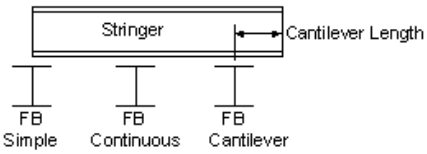
**Number of floorbeams that support this stringer group definition:** 2

**All floorbeams are perpendicular to the structure definition reference line:** Yes

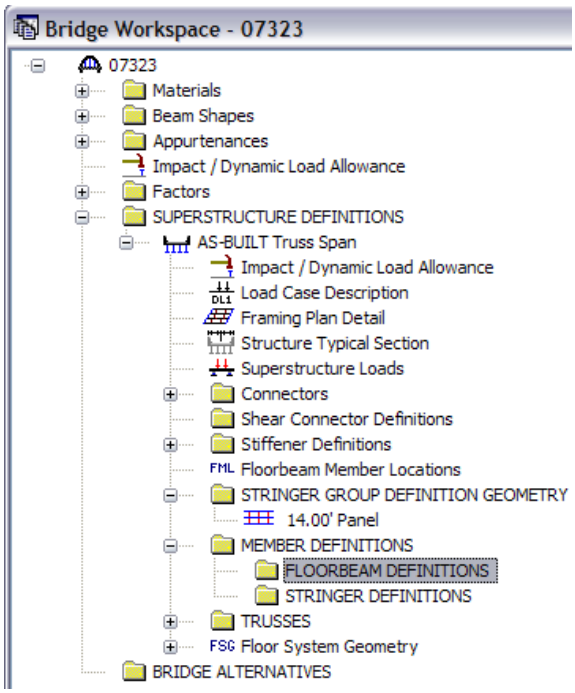
**Stringer Support:** For this example, select **Simple** from the drop down menu. The user can select a simple support, a cantilever support or a simple, offset support. See diagrams to the left.

Left click **OK** to accept and close.

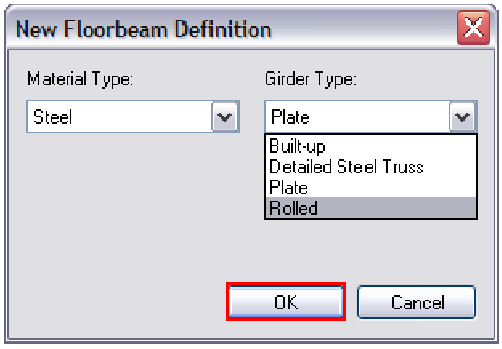


## MEMBER DEFINITIONS: FLOORBEAM DEFINITIONS



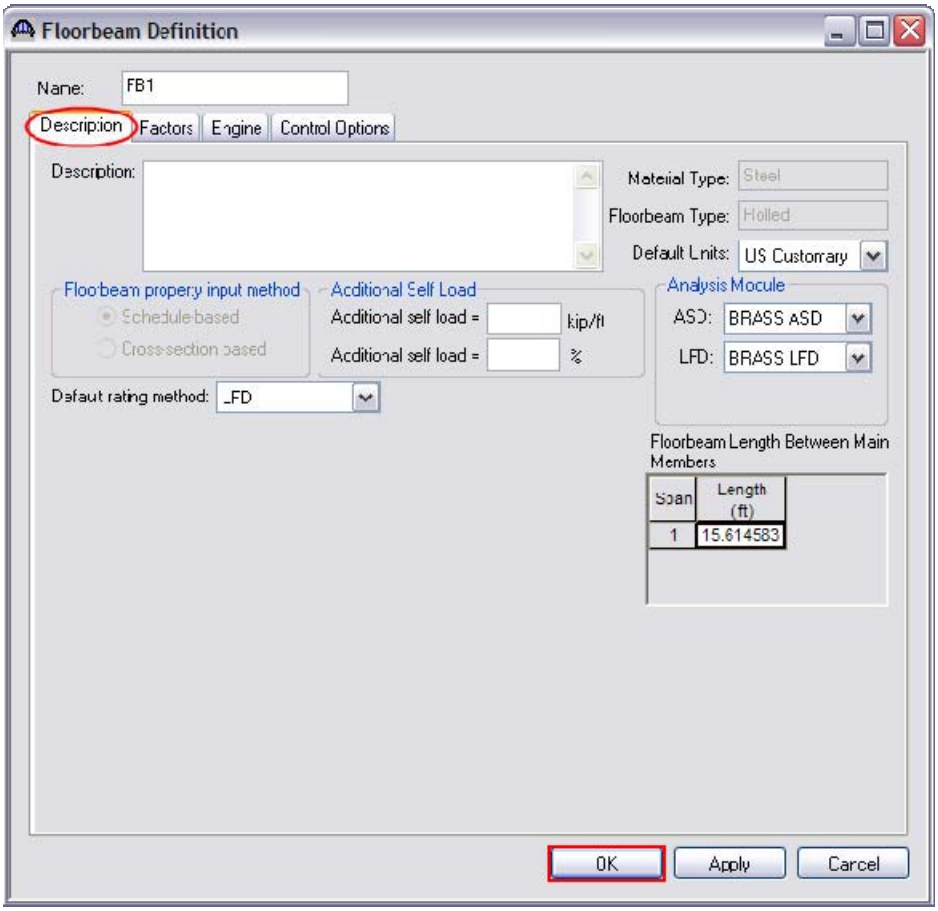

Expand the **MEMBER DEFINITIONS** and double click **FLOORBEAM DEFINITIONS** to create a new definition.




Select the material. **Steel** is the only available option.

Select **Rolled** from the **Girder Type** drop down menu.

Left click **OK** to accept and close.




**Description** Tab:

**Name:** FB1

**Floorbeam property input method:** User can either select **Schedule-based** or **Cross-section** based. For schedule based, the user defines the floorbeam in terms of a profile. A beam shape is selected and then defined over a length. For cross-section based, the user defines unique cross sections and then defines the cross section over a certain length. For this example, select **Schedule-based**.

**Additional Self-Load:** User can add additional self-weight to the floorbeam either in terms of kip/ft or a percentage of the beam weight. This can be used to account for bolts, splices, pin and hangers, etc. No input required for this example.

**Analysis Module:** Only the **BRASS ASD** and **BRASS LFD** modules are available.

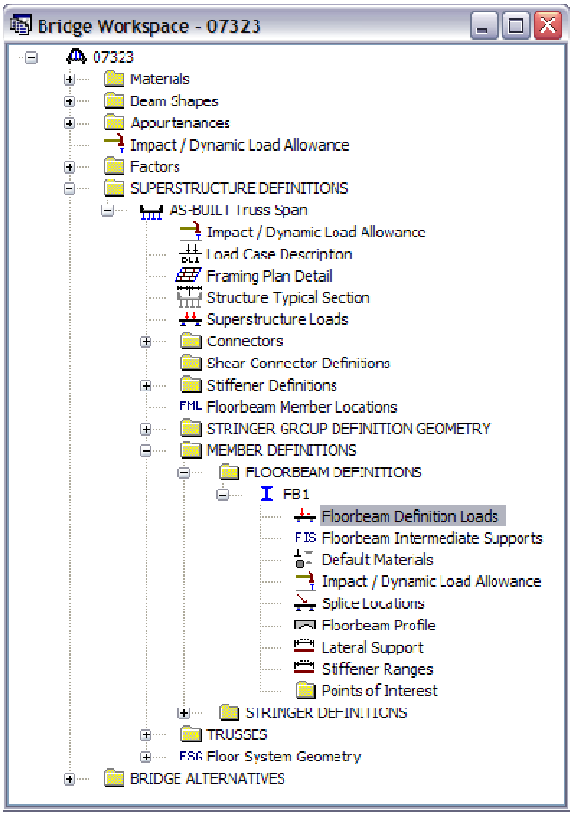
**Default Rating Method:** LFD (Virtis cannot analyze a truss in any other rating method).

**Floorbeam Length between Main Members:** 15.614583 ft.

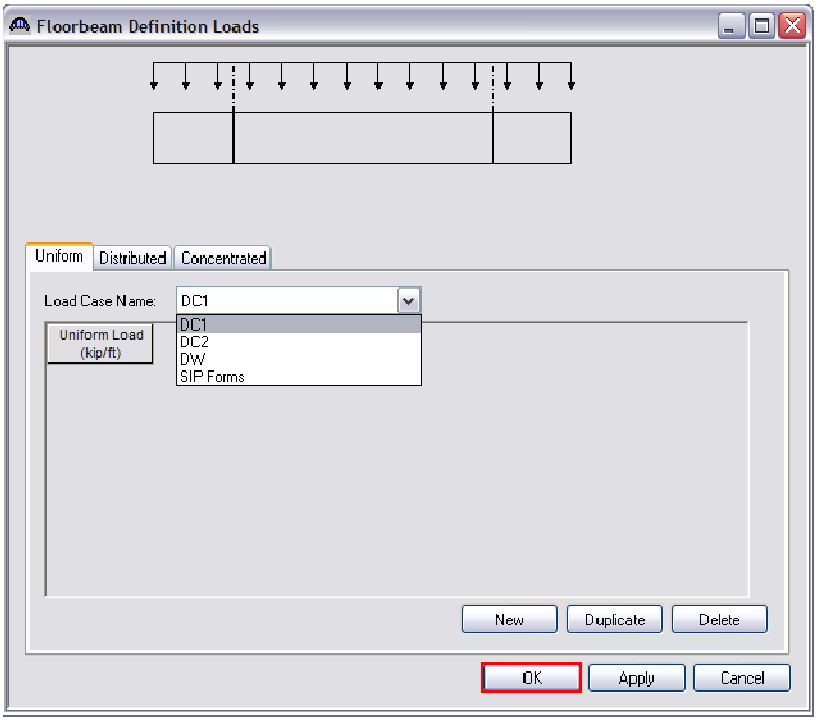
Input for the **Factors**, **Engine**, and **Control Options** tabs is not required.

Left click **OK** to accept and close.

## FLOORBEAM DEFINITION LOADS



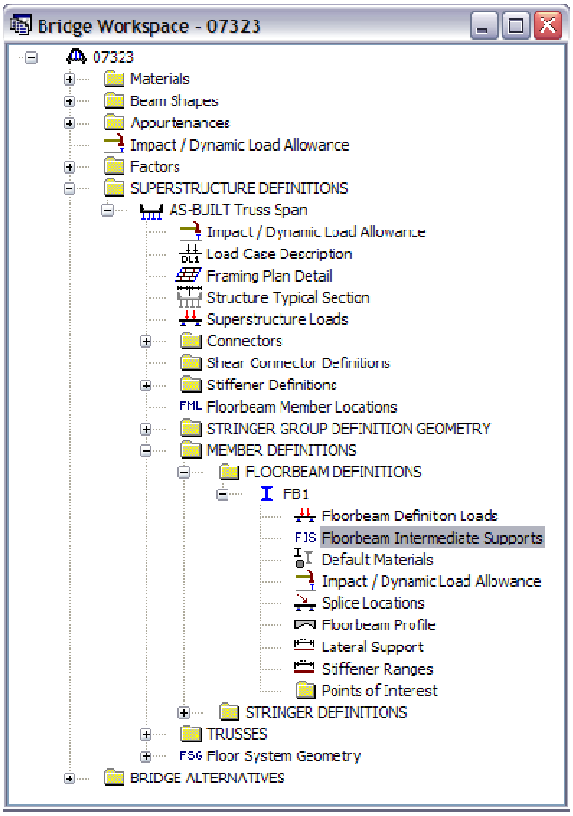

Double click **Floorbeam Definition Loads**.



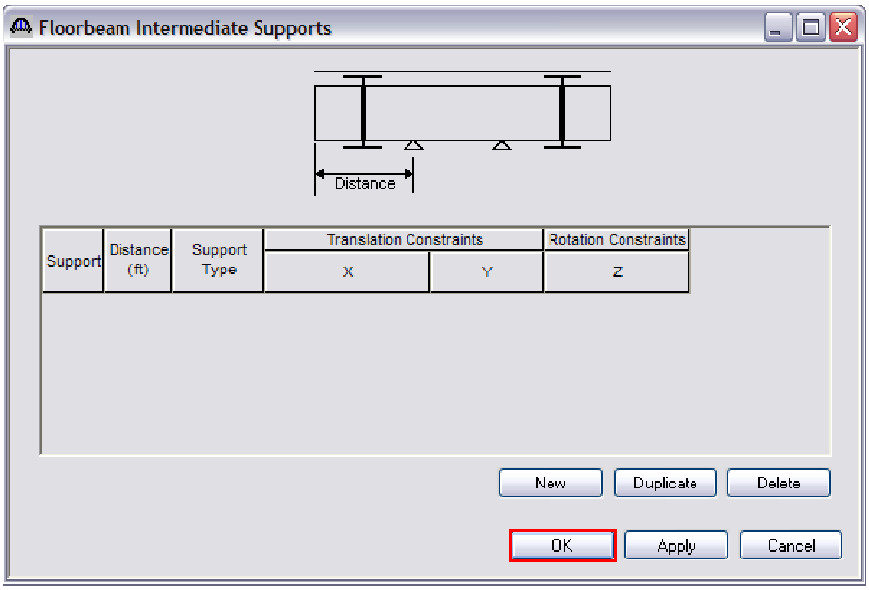

The user can add additional load to the floorbeam other than the load from the deck, stringers, etc. that Virtis automatically applies. This load can be applied as uniform, distributed, or concentrated. For this example, no additional load is required.

Left click **OK** to accept and close.

## FLOORBEAM INTERMEDIATE SUPPORTS



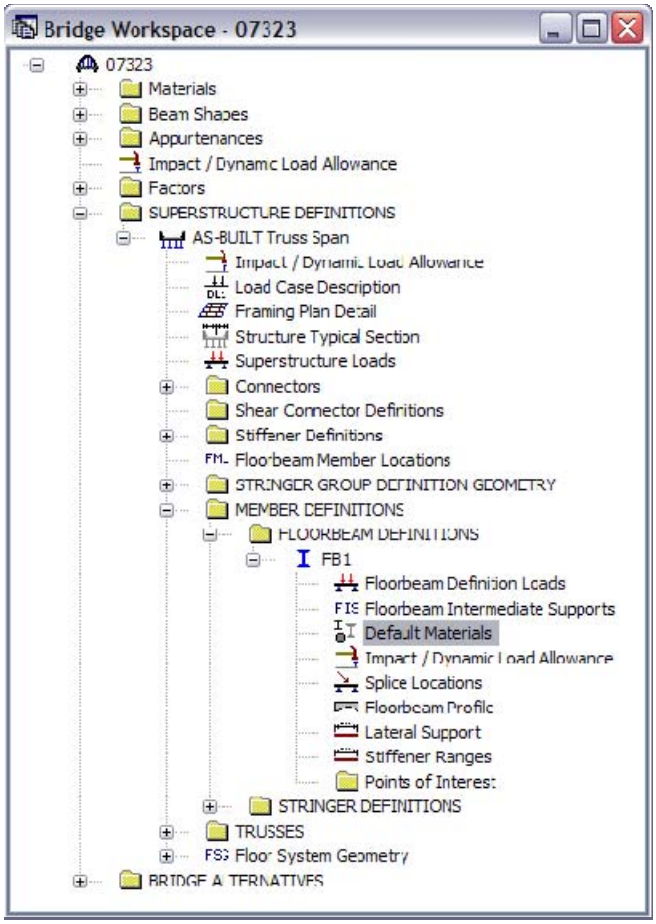

Double click **Floorbeam Intermediate Supports**.



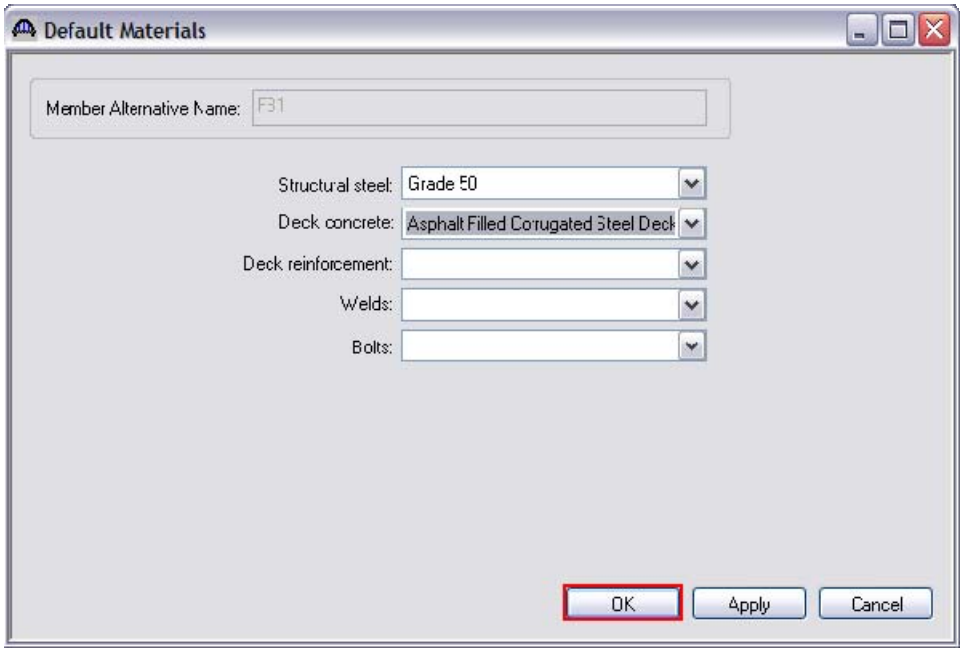

This user can define additional intermediate supports for floorbeam members that span between main girders. The main girder locations are considered to support the floorbeam and thus intermediate supports should not be placed at the same locations as the main girder locations. For this example, no additional intermediate supports are required.

Left click **OK** to accept and close.

## DEFAULT MATERIALS



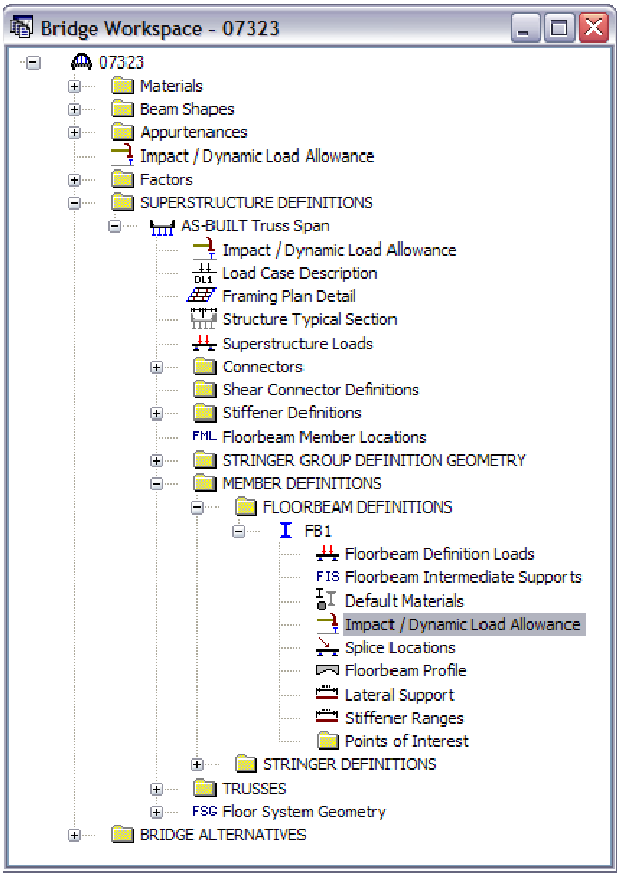

Double click **Default Materials**.



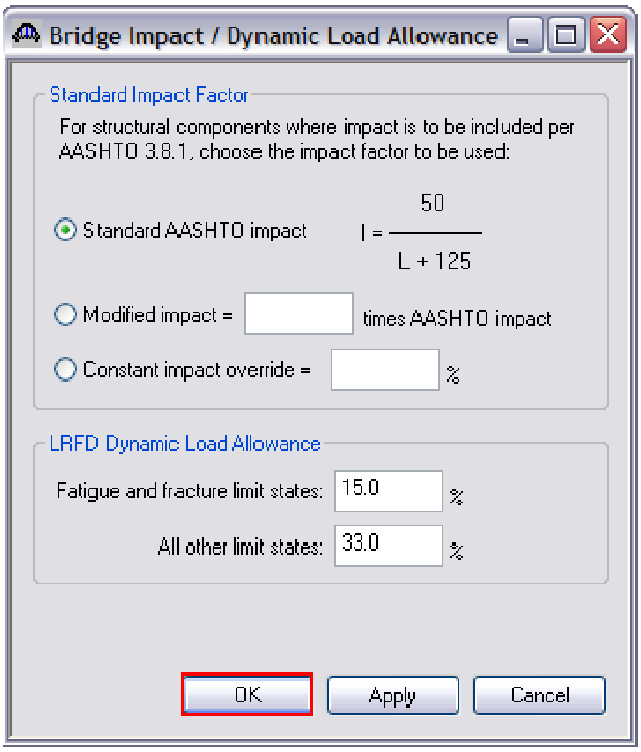

The materials initially shown in this window are correct.

Left click **OK** to accept and close.

## SELECTING IMPACT/DYNAMIC LOAD ALLOWANCES



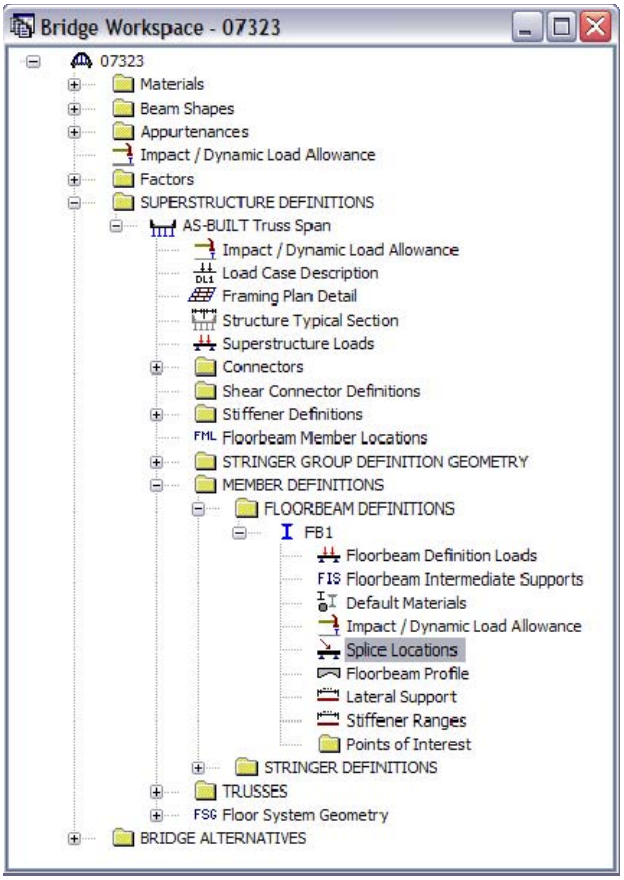

Double click **Impact / Dynamic Load Allowance** to open.



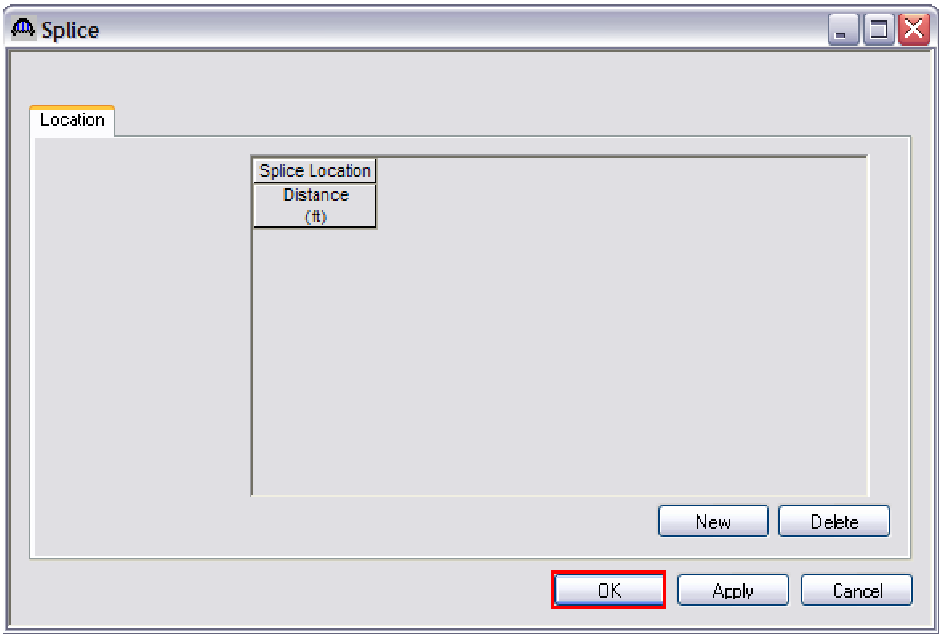

**Standard Impact Factor:** Select **Standard AASHTO impact**, which is the default setting.

Left click the **OK** button to accept and close.

## SPLICE LOCATIONS



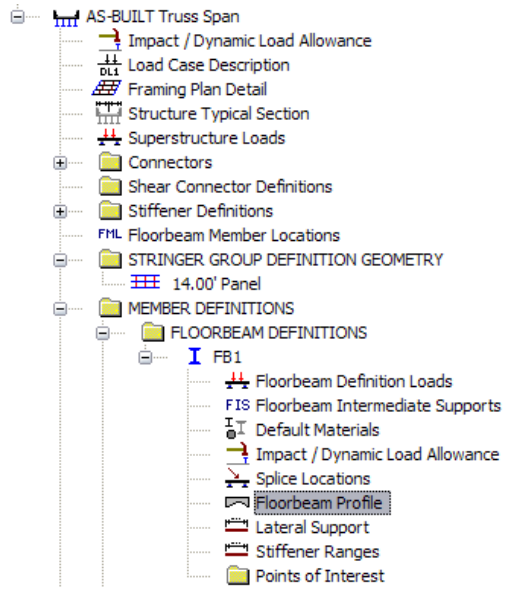

Double click **Splice Locations**.



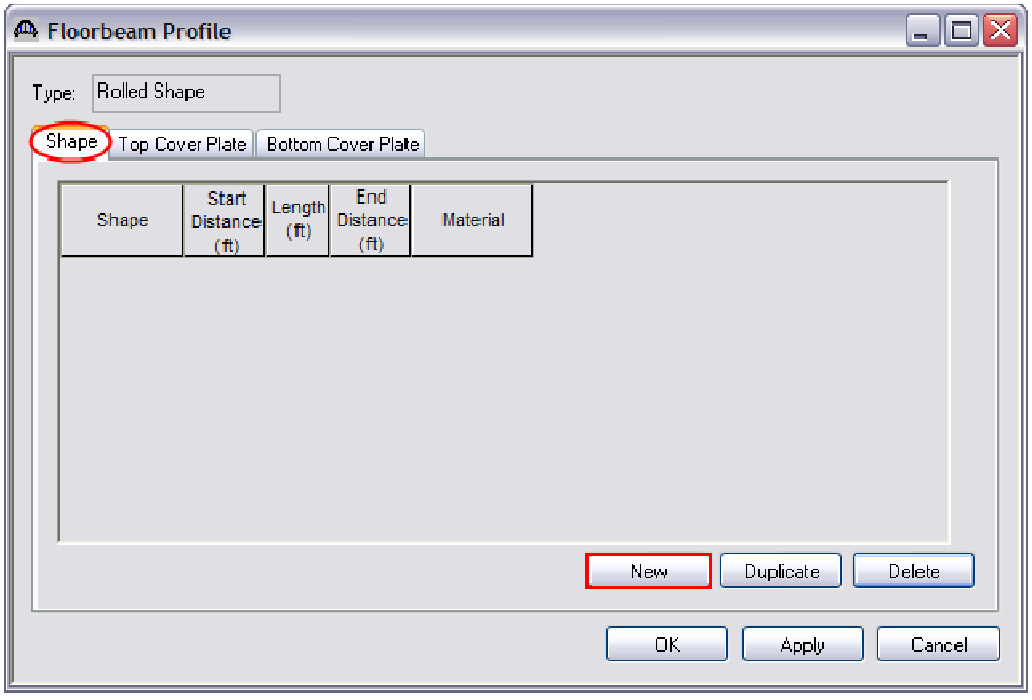

The user can define a splice location in the floorbeam. However, there are no splices for this example.

Left click **OK** to accept and close.

## FLOORBEAM PROFILE

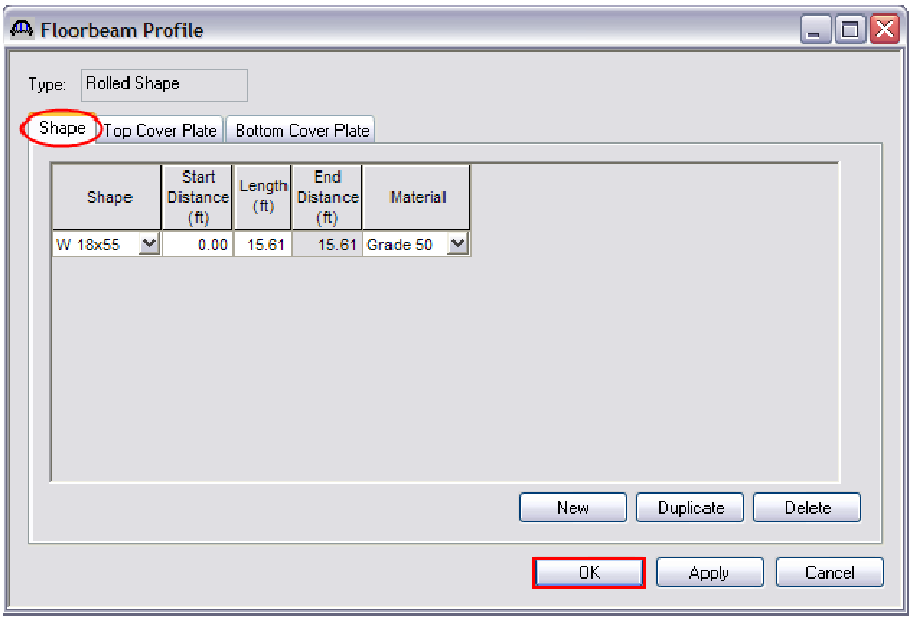



Double click **Floorbeam Profile**.




**Shape** tab:

Left click the **New** button.




**Shape:** Select **W18x55** from the drop down menu.

**Start Distance:** 0.00 ft.

**Length:** 15.614583 ft.

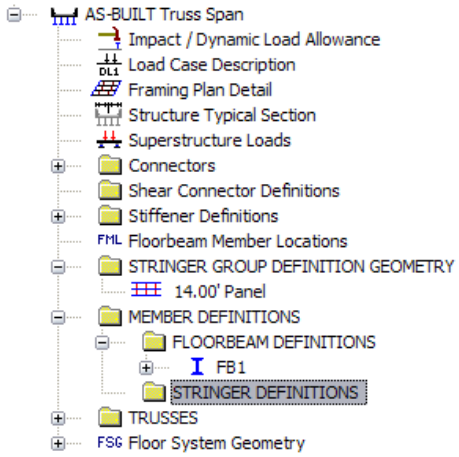
**Material:** Select Grade 50 from the drop down menu.

Since there are no top or bottom cover plates, the other tabs can be ignored.

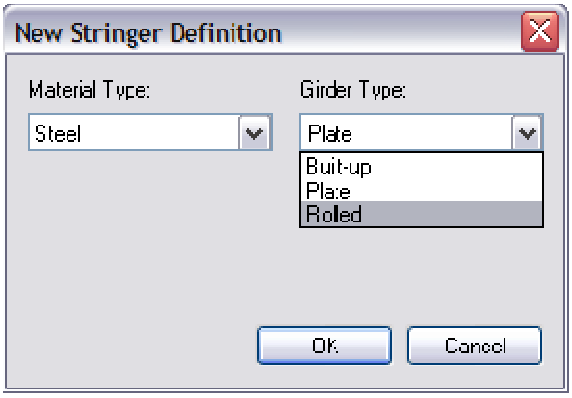
Left click **OK** to accept and close.

*****Since the top flange of the floorbeams is not laterally supported and there are no web stiffeners, the input for the floorbeam definition is complete. Based on the plans, there is only one floorbeam definition required.**

## MEMBER DEFINITIONS: STRINGER DEFINITIONS

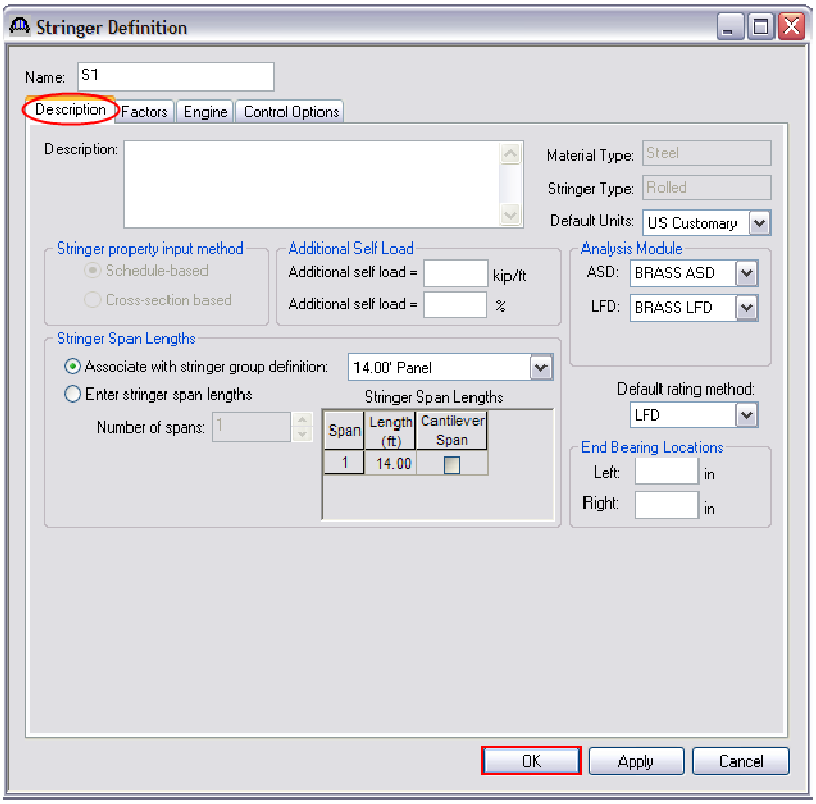



Double click **STRINGER DEFINITIONS**.




Select the material. **Steel** is the only available option.

Select **Rolled** from the **Girder Type** drop down menu.




**Description** Tab:

**Name:** S1

**Stringer property input method:** User can either select **Schedule-based** or **Cross-section** based. For schedule based, the user defines the stringer in terms of a profile. A beam shape is selected and then defined over a length. For cross-section based, the user defines unique cross sections and then defines the cross section over a certain length. For this example, select **Schedule-based**.

**Additional Self-Load:** User can add additional self-weight to the floorbeam either in terms of kip/ft or a percentage of the beam weight. This can be used to account for bolts, splices, pin and hangers, etc. No input required for this example.

**Analysis Module:** Only the **BRASS ASD** and **BRASS LFD** modules are available.

**Stringer Span Lengths:** Select **Associate with Stringer Group Definition** and select **14.00' Panel** from the drop down menu.

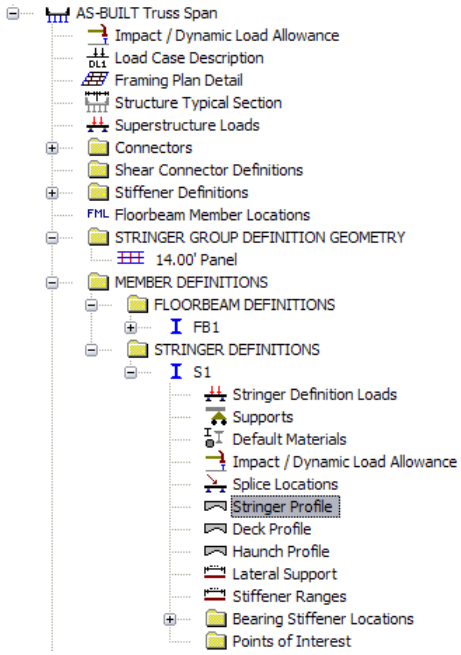
**Default Rating Method:** LFD (Virtis cannot analyze a truss in any other rating method).

**End Bearing Location:** User can enter the distance from the centerline of the end bearing to the beginning or end of the stringer. This value is used to determine the total length of the stringer definition. Leave these fields blank for this example since the stringer supports were defined as **Simple** for the floorbeam profile.

Input for the **Factors**, **Engine**, and **Control Options** tabs is not required.

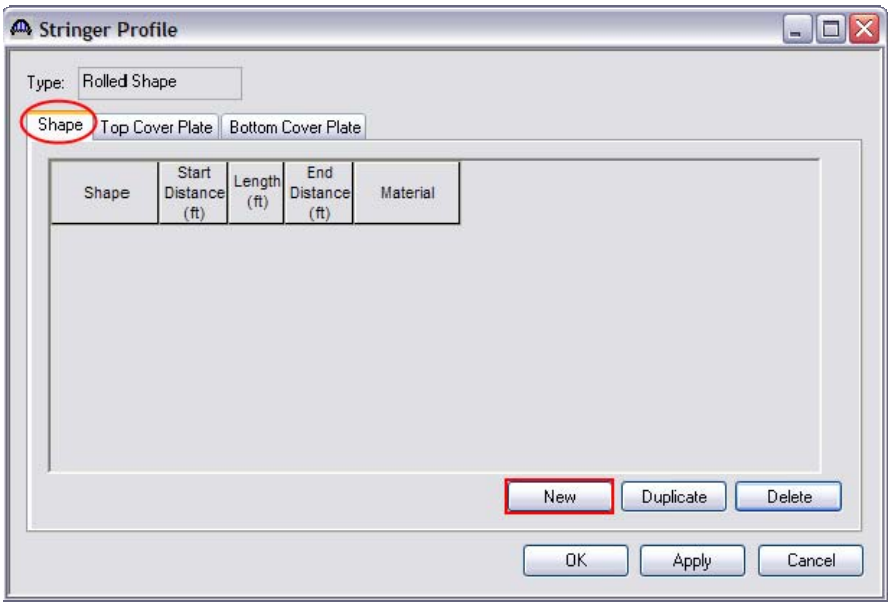
Left click **OK** to accept and close.

## STRINGER PROFILE



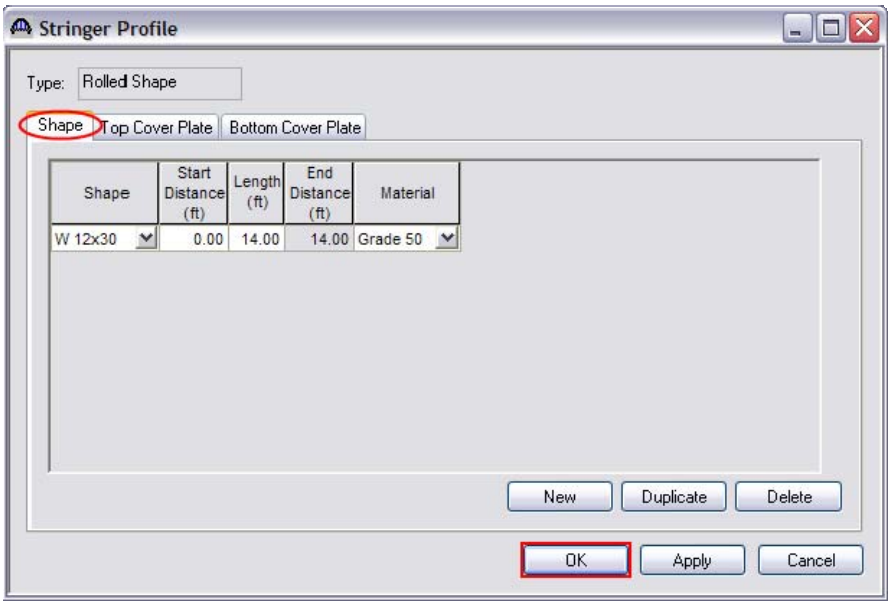

Similar to the Floorbeam Profile, input for **Stringer Definition Loads, Supports, Default Materials, Impact/Dynamic Load Allowance, and Splice Locations** does not need to be changed.

Therefore, double click **Stringer Profile**.




**Shape** Tab:

Left click the **New** button.




**Shape:** Select **W12x30** from the drop down menu.

**Start Distance:** 0.00 ft.

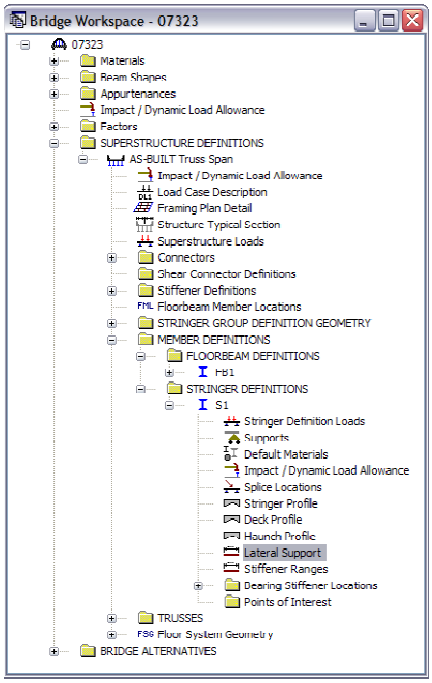
**Length:** 14.00 ft.

**Material:** Select Grade 50 from the drop down menu.

Since there are no top or bottom cover plates, the other tabs can be ignored.

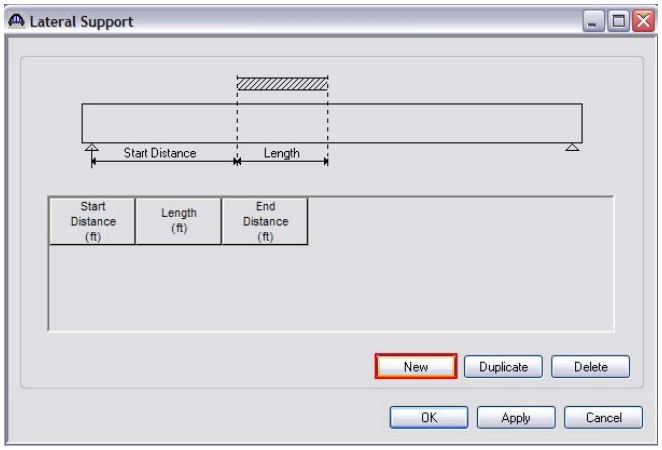
Left click **OK** to accept and close.

## LATERAL SUPPORT

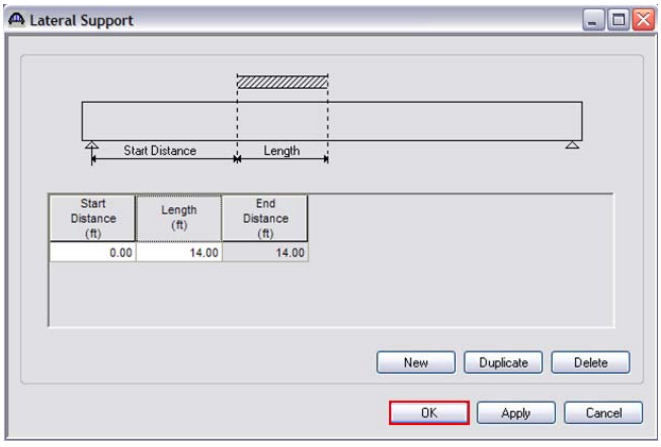



The user can define the top flange of the stinger definition as laterally supported along its length. According to the plans, the stringers are welded to the corrugated steel floor at every corrugation. Therefore, the top flange can be considered to be laterally supported.

Double click **Lateral Support**.




Left click the **New** button.



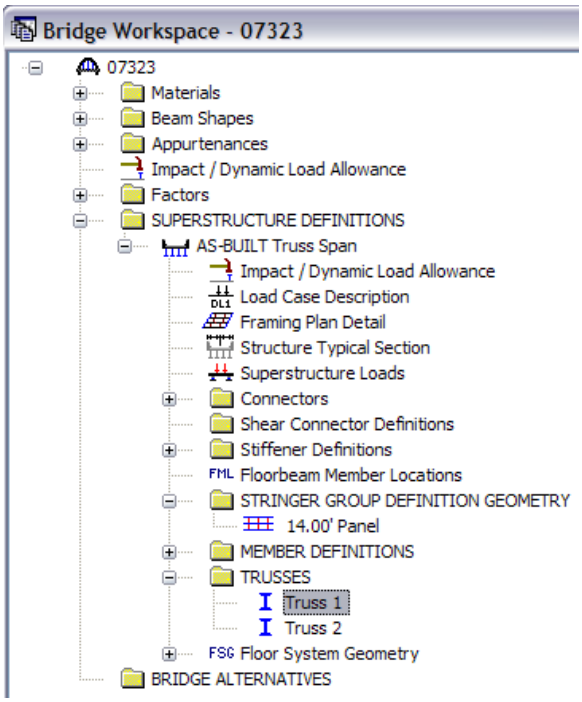

**Start Distance:** 0.00 ft.

**Length:** 14.00 ft.

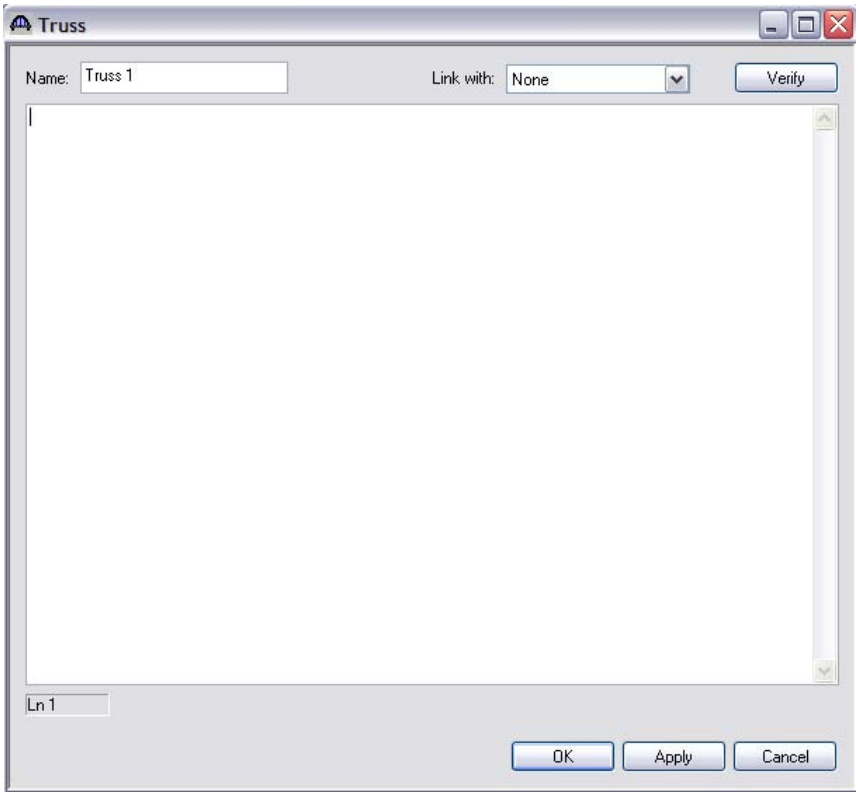
*****Since there are no web stiffeners, the input for the stringer definition is complete.**

Left click **OK** to accept and close.

## DEFINING THE TRUSS




Expand the **TRUSSES** folder and double click **Truss 1**.




The Truss Input Command window will appear.

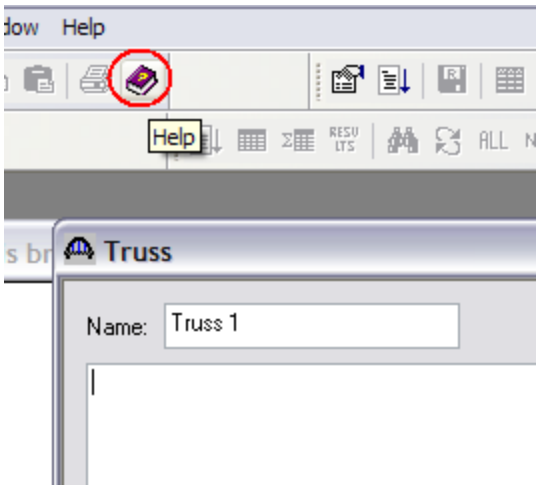
All input for the truss will be in this window.

The user can check their work by left clicking the **Verify** button.

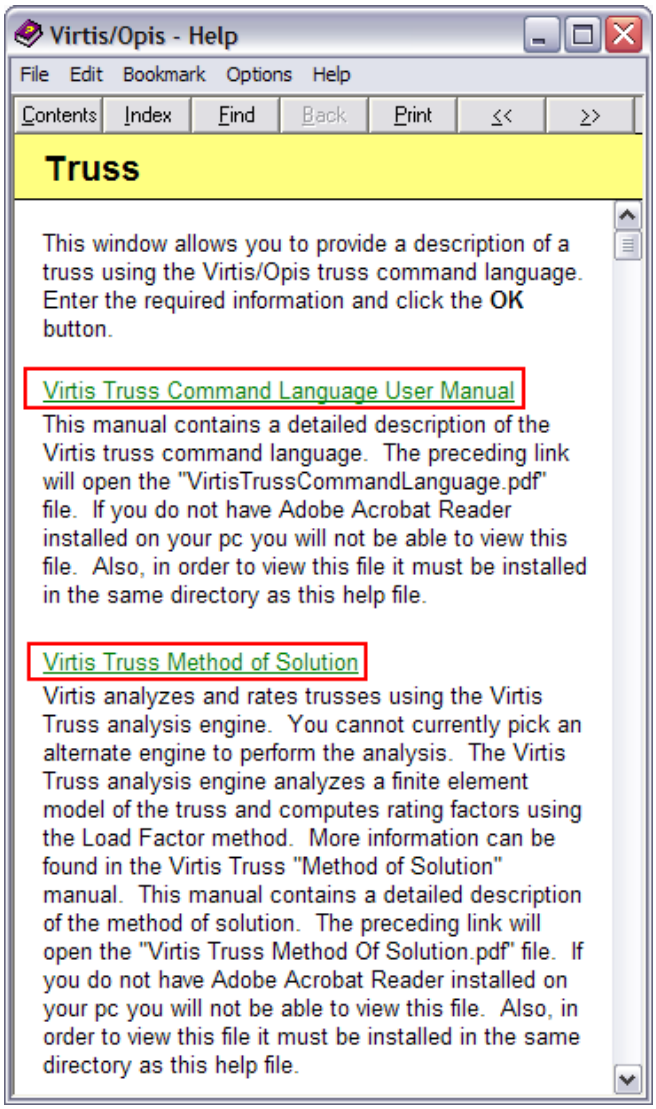
A window indicating warnings and errors will appear which will direct the user on which, if any, input needs revised.

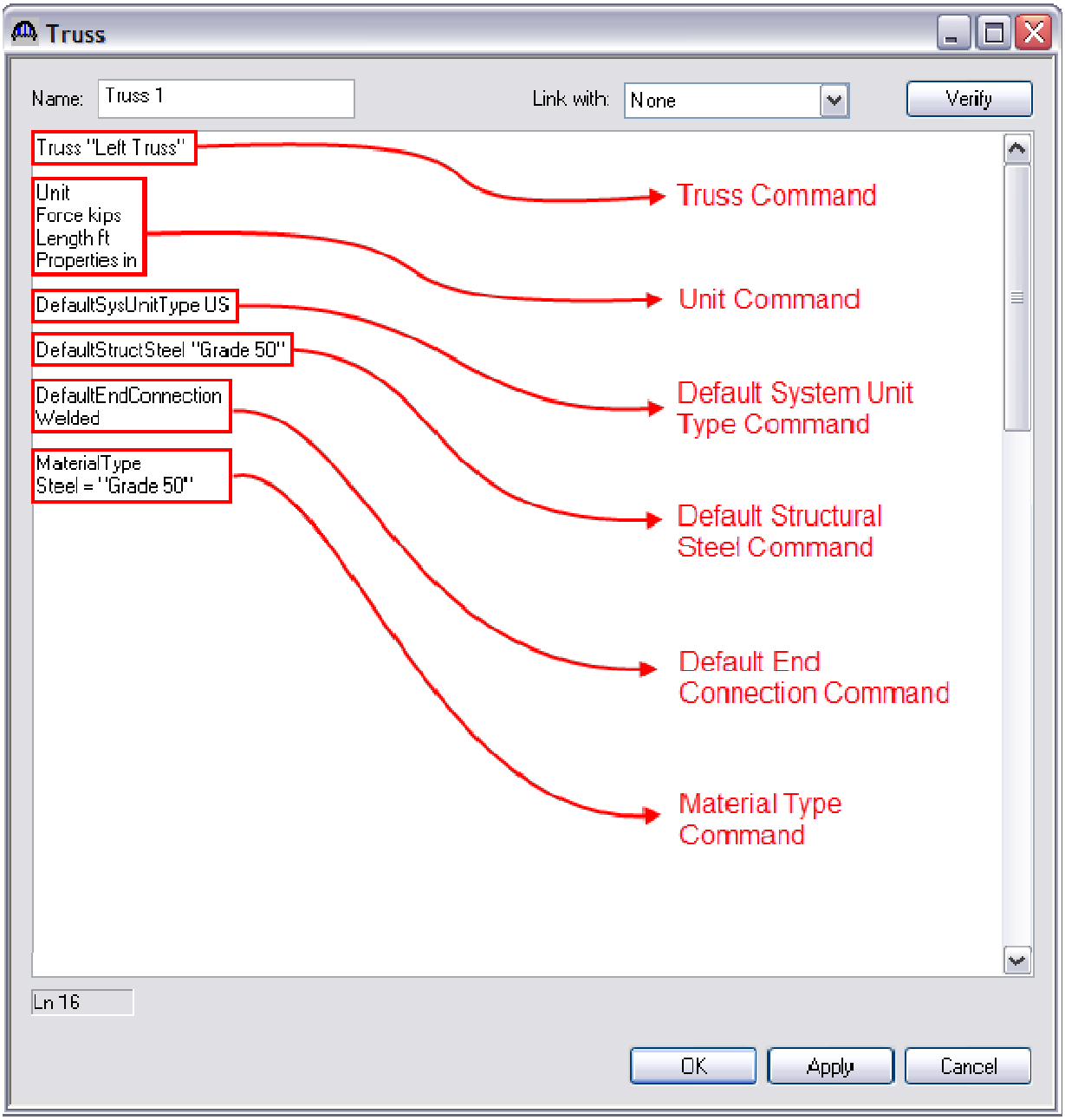
Clicking **Verify** at this point will result with a window stating, “Please enter truss description…”

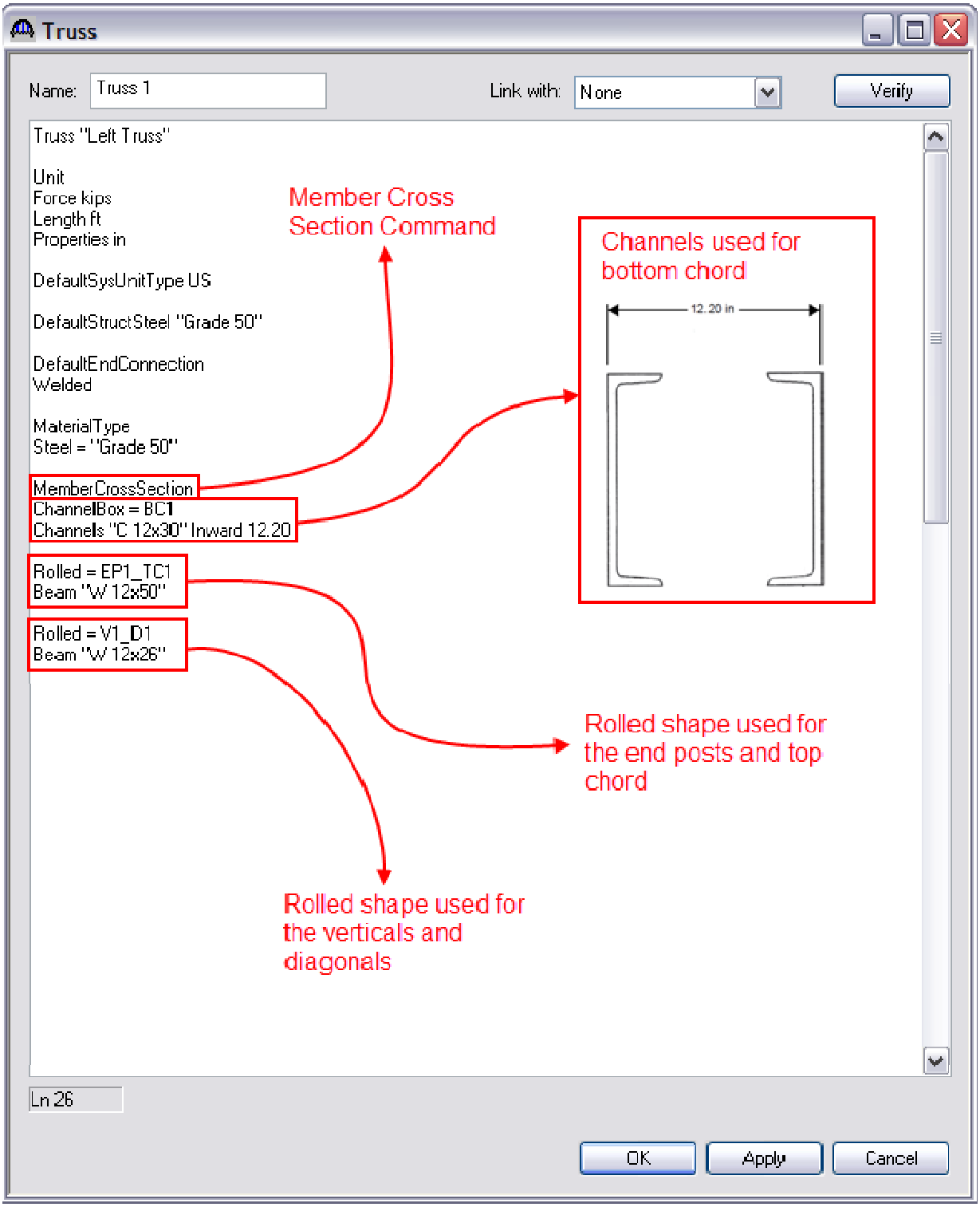
Left click **OK**.



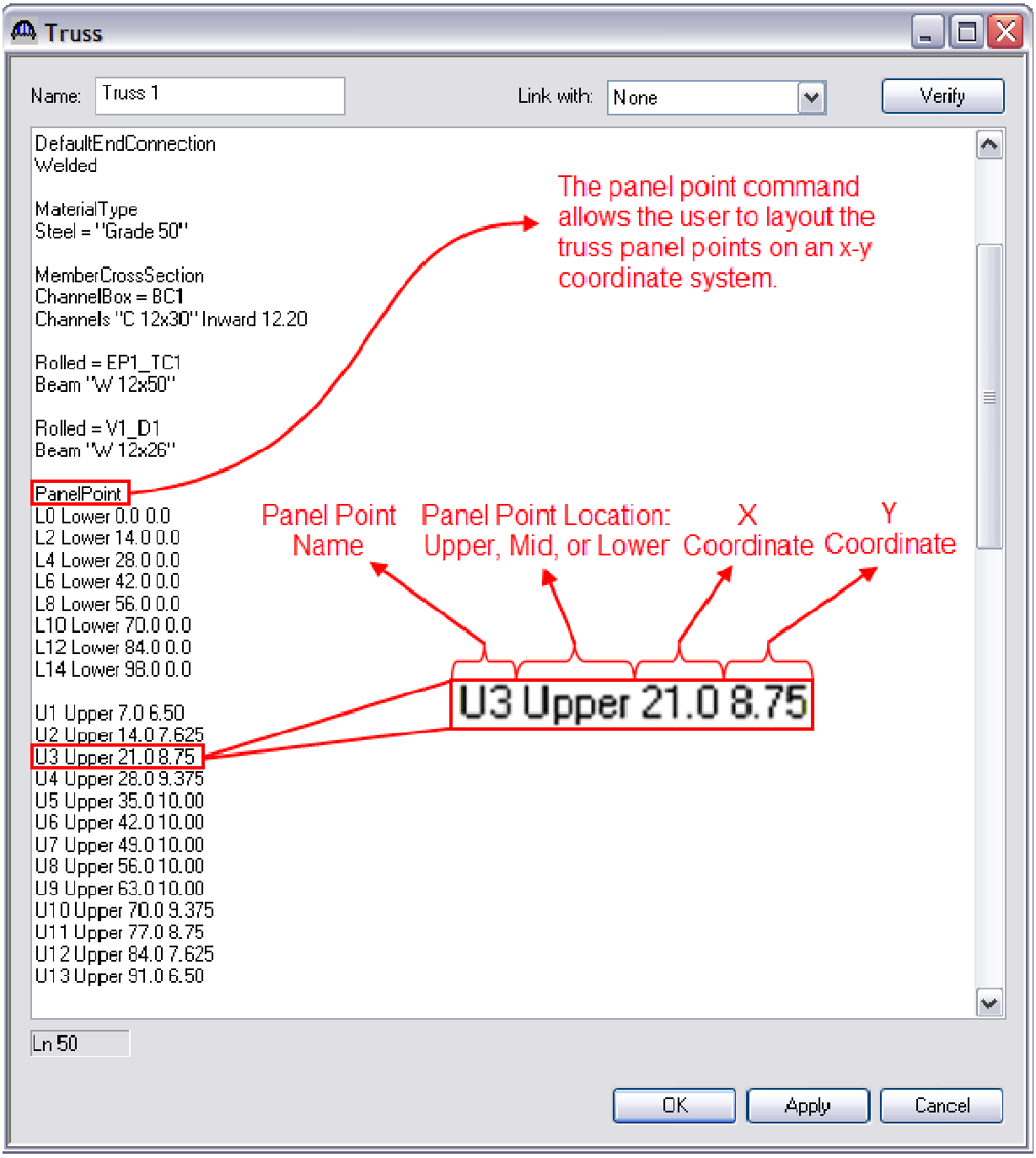

The user can view the Virtis Truss Command Language User Manual and the Virtis Truss Method of Solution by left clicking the **Help** icon when the truss input window is open and then following the links on the help window.


Virtis/Opis - Help
File Edit Bookmark Options Help
Contents Index Find Back Print << >>
Truss
This window allows you to provide a description of a truss using the Virtis/Opis truss command language. Enter the required information and click the OK button.
Virtis Truss Command Language User Manual
This manual contains a detailed description of the Virtis truss command language. The preceding link will open the "VirtisTrussCommandLanguage.pdf" file. If you do not have Adobe Acrobat Reader installed on your pc you will not be able to view this file. Also, in order to view this file it must be installed in the same directory as this help file.
Virtis Truss Method of Solution
Virtis analyzes and rates trusses using the Virtis Truss analysis engine. You cannot currently pick an alternate engine to perform the analysis. The Virtis Truss analysis engine analyzes a finite element model of the truss and computes rating factors using the Load Factor method. More information can be found in the Virtis Truss "Method of Solution" manual. This manual contains a detailed description of the method of solution. The preceding link will open the "Virtis Truss Method Of Solution.pdf" file. If you do not have Adobe Acrobat Reader installed on your pc you will not be able to view this file. Also, in order to view this file it must be installed in the same directory as this help file.

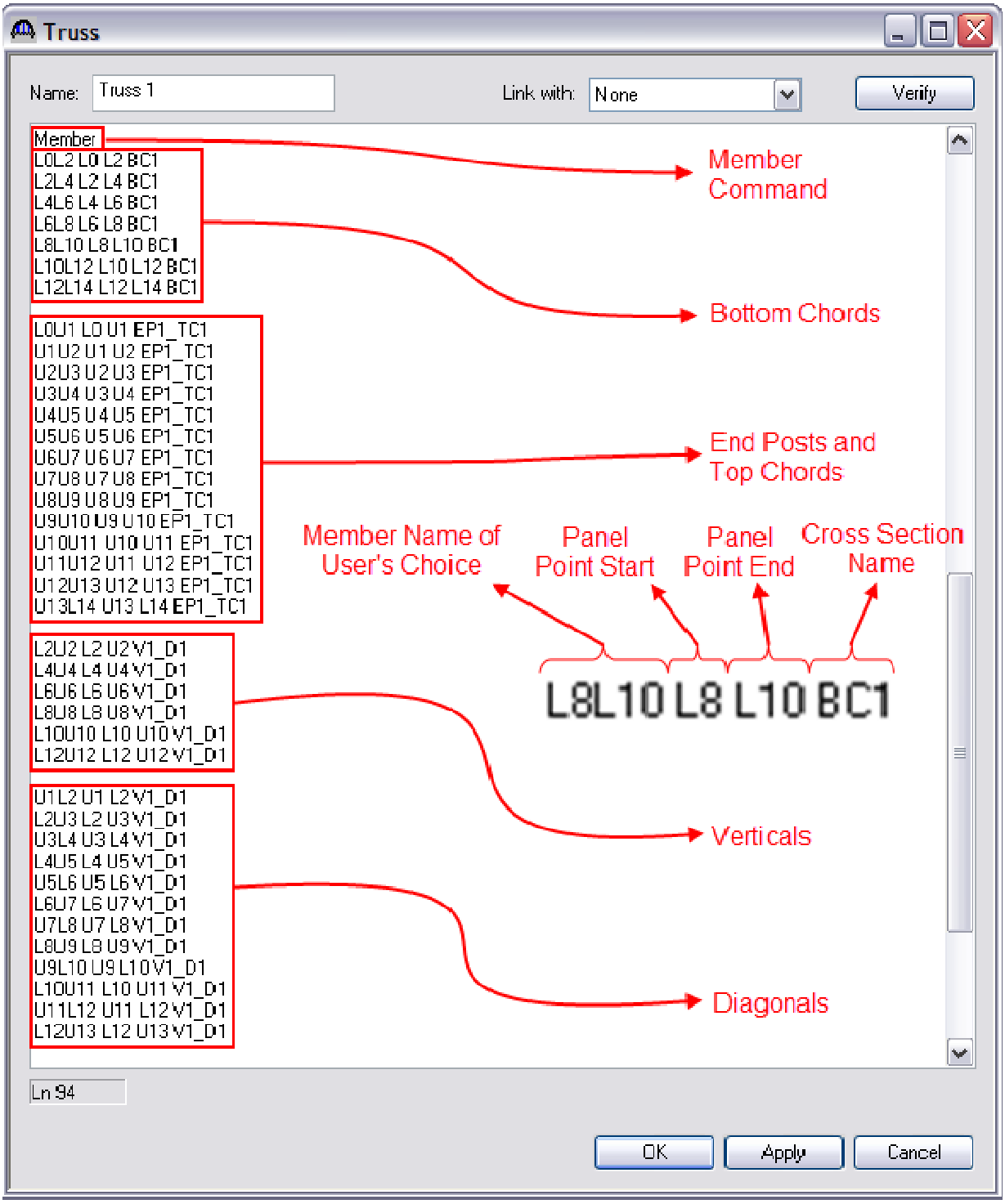

Truss
Name: Truss 1
Link with: None
Verify
Truss "Left Truss"
Unit
Force kips
Length ft
Properties in
DefaultSysUnitType US
DefaultStructSteel "Grade 50"
DefaultEndConnection
Welded
MaterialType
Steel = "Grade 50"
Truss Command
Unit Command
Default System Unit Type Command
Default Structural Steel Command
Default End Connection Command
Material Type Command
Ln 16
OK
Apply
Cancel



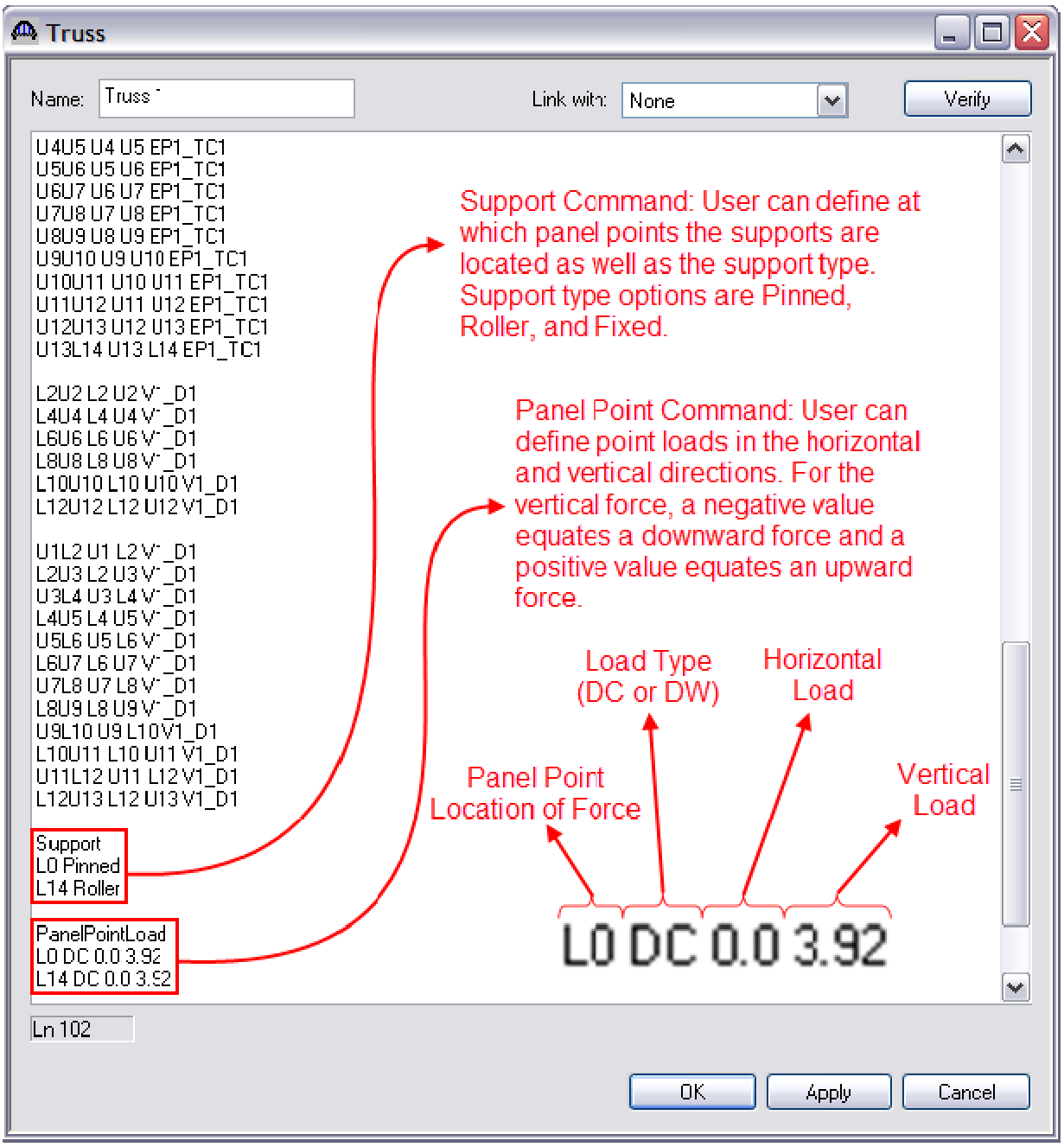

**Note:** Beam designation needs to match exactly the names specified in the **Beam Shapes**.




**Note:** Each input is separated by a space.

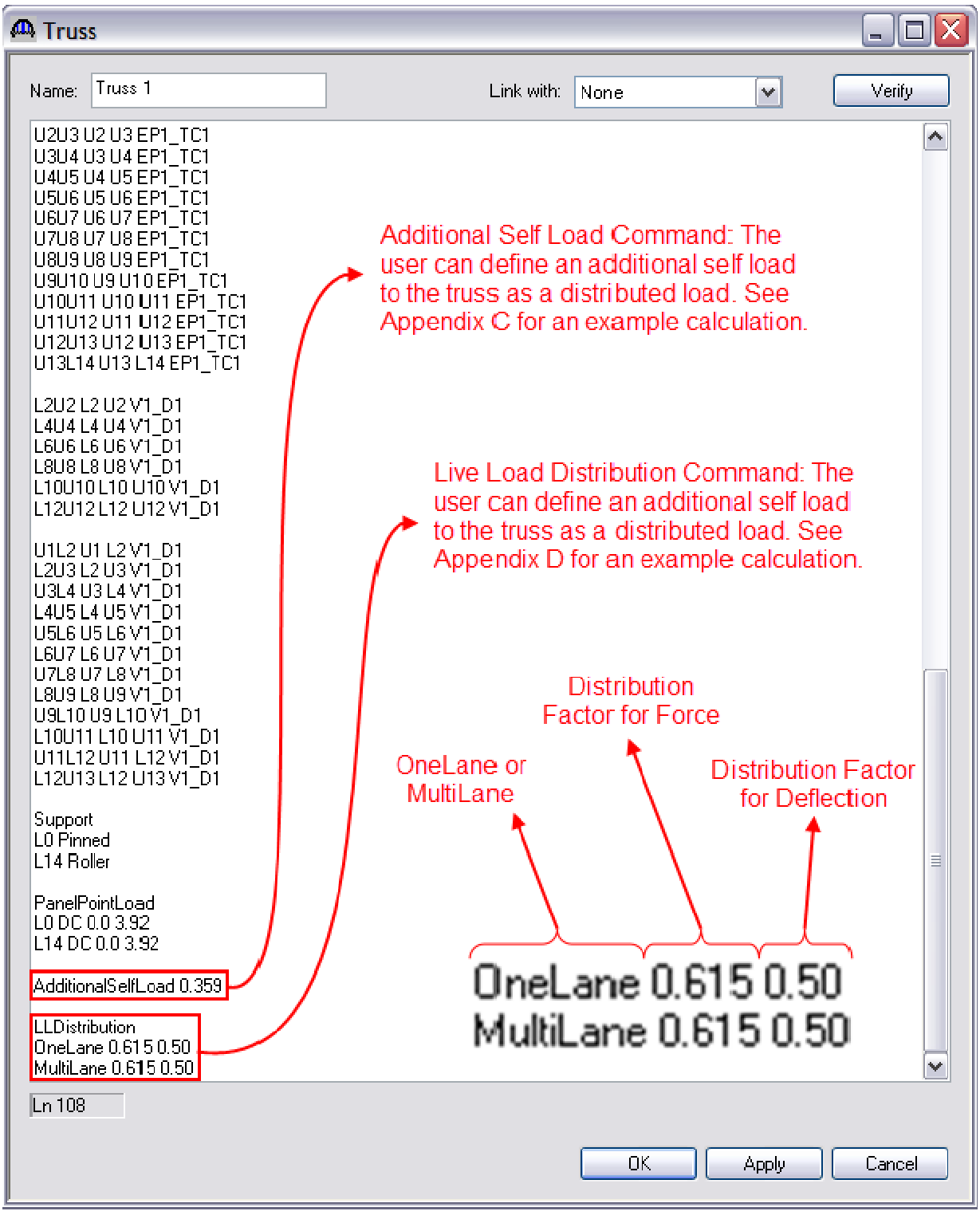



**Note:** Each input is separated by a space.

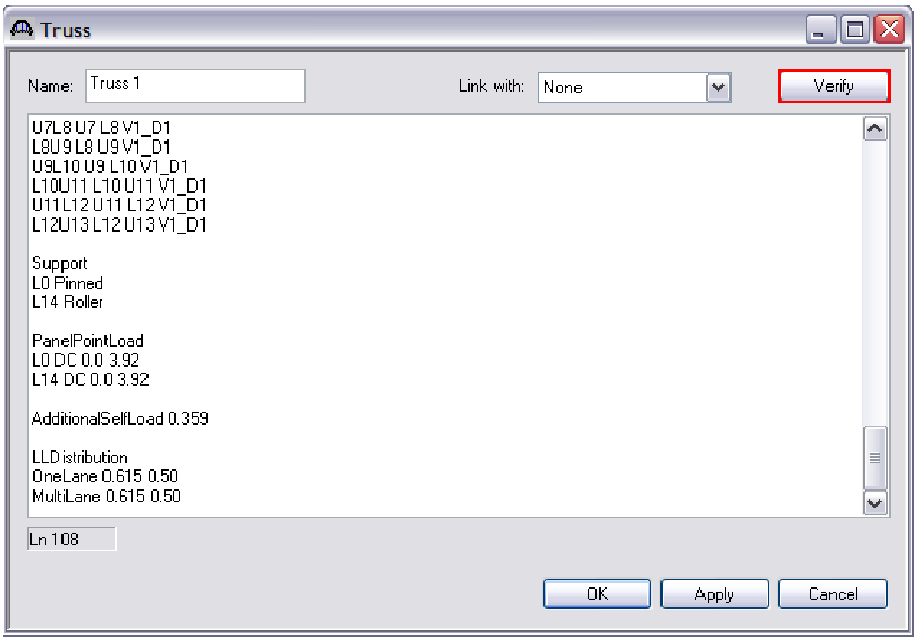

Truss
Name: Truss
Link with: None
Verify
U4U5 U4 U5 EP1_TC1
U5U6 U5 U6 EP1_TC1
U6U7 U6 U7 EP1_TC1
U7U8 U7 U8 EP1_TC1
U8U9 U8 U9 EP1_TC1
U9U10 U9 U10 EP1_TC1
U10U11 U10 U11 EP1_TC1
U11U12 U11 U12 EP1_TC1
U12U13 U12 U13 EP1_TC1
U13L14 U13 L14 EP1_TC1
L2U2 L2 U2 V_D1
L4U4 L4 U4 V_D1
L6U6 L6 U6 V_D1
L8U8 L8 U8 V_D1
L10U10 L10 U10 V1_D1
L12U12 L12 U12 V1_D1
U1L2 U1 L2 V_D1
L2U3 L2 U3 V_D1
U3L4 U3 L4 V_D1
L4U5 L4 U5 V_D1
U5L6 U5 L6 V_D1
L6U7 L6 U7 V_D1
U7L8 U7 L8 V_D1
L8U9 L8 U9 V_D1
U9L10 U9 L10 V1_D1
L10U11 L10 U11 V1_D1
U11L12 U11 L12 V1_D1
L12U13 L12 U13 V1_D1
Support
L0 Pinned
L14 Roller
PanelPointLoad
L0 DC 0.0 3.92
L14 DC 0.0 3.92
Ln 102
OK
Apply
Cancel
Support Command: User can define at which panel points the supports are located as well as the support type. Support type options are Pinned, Roller, and Fixed.
Panel Point Command: User can define point loads in the horizontal and vertical directions. For the vertical force, a negative value equates a downward force and a positive value equates an upward force.
Load Type (DC or DW)
Horizontal Load
Panel Poirt Location of Force
Vertical Load
L0 DC 0.0 3.92

**Note:** For this example, an upward force was placed at the end supports since fictitious floorbeams were placed at these locations. The stringers rest directly on the abutments rather than a floorbeam. These panel point loads will not be initially known.

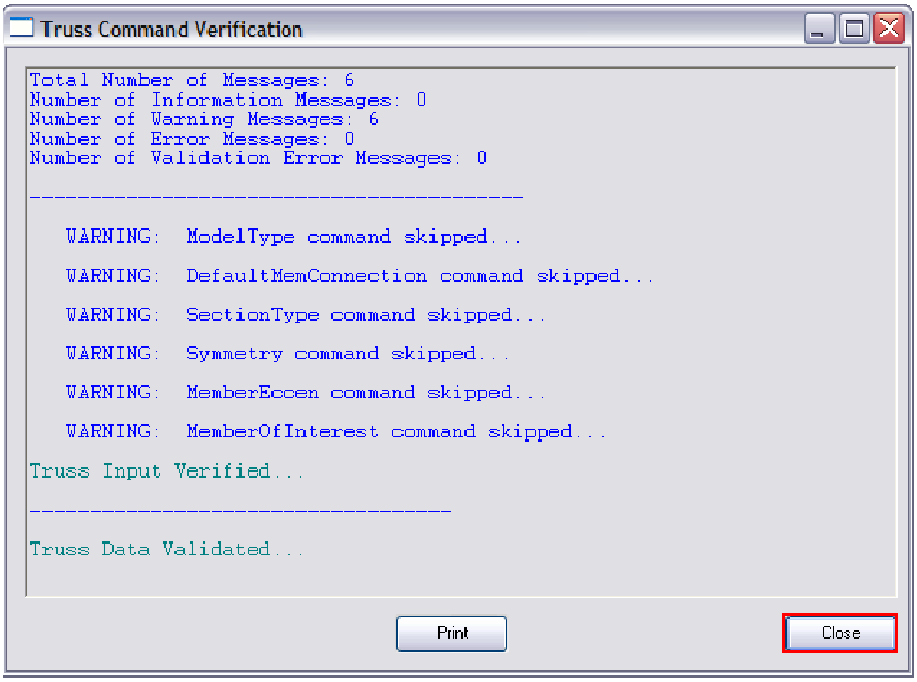
To get this information, analyze the truss once with 0.00 kips for the panel point vertical load, follow through with the load calculation in Appendix B, and then insert the result into the truss input command window.


Truss
Name: Truss 1
Link with: None
Verify
U2U3 U2 U3 EP1_TC1
U3U4 U3 U4 EP1_TC1
U4U5 U4 U5 EP1_TC1
U5U6 U5 U6 EP1_TC1
U6U7 U6 U7 EP1_TC1
U7U8 U7 U8 EP1_TC1
U8U9 U8 U9 EP1_TC1
U9U10 U9 U10 EP1_TC1
U10U11 U10 U11 EP1_TC1
U11U12 U11 U12 EP1_TC1
U12U13 U12 U13 EP1_TC1
U13L14 U13 L14 EP1_TC1
L2U2 L2 U2 V1_D1
L4U4 L4 U4 V1_D1
L6U6 L6 U6 V1_D1
L8U8 L8 U8 V1_D1
L10U10 L10 U10 V1_D1
L12U12 L12 U12 V1_D1
U1L2 U1 L2 V1_D1
L2U3 L2 U3 V1_D1
U3L4 U3 L4 V1_D1
L4U5 L4 U5 V1_D1
U5L6 U5 L6 V1_D1
L6U7 L6 U7 V1_D1
U7L8 U7 L8 V1_D1
L8U9 L8 U9 V1_D1
U9L10 U9 L10 V1_D1
L10U11 L10 U11 V1_D1
U11L12 U11 L12 V1_D1
L12U13 L12 U13 V1_D1
Support
L0 Pinned
L14 Roller
PanelPointLoad
L0 DC 0.0 3.92
L14 DC 0.0 3.92
AdditionalSelfLoad 0.359
LLDistribution
OneLane 0.615 0.50
MultiLane 0.615 0.50
Ln 108
OK
Apply
Cancel
Additional Self Load Command: The user can define an additional self load to the truss as a distributed load. See Appendix C for an example calculation.
Live Load Distribution Command: The user can define an additional self load to the truss as a distributed load. See Appendix D for an example calculation.
Distribution Factor for Force
OneLane or MultiLane
Distribution Factor for Deflection
OneLane 0.615 0.50
MultiLane 0.615 0.50

**Note:** The additional self-load will not be initially known. Rather, analyze the truss once with an additional self-load of 0.000 kip/ft, follow through with the calculation in Appendix C, and then insert the calculated distributed self-load into the truss input command window.




Left click the **Verify** button to verify the data.



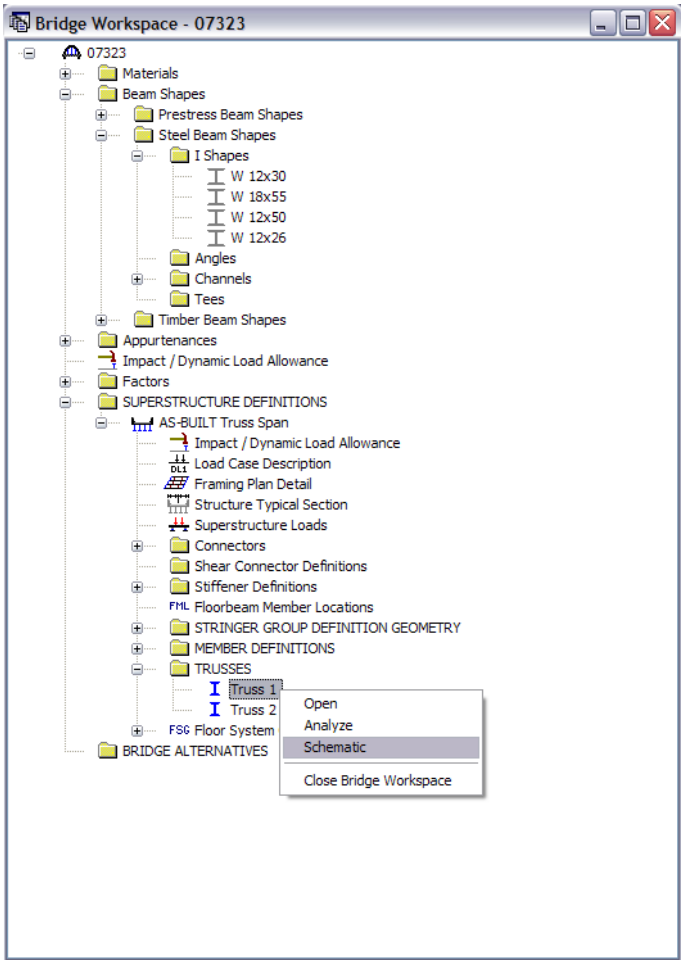

Several warnings will appear as shown, but they are all commands that are not necessary for this example.

If any errors appear, the user will have to revise the data before the truss can be analyzed. Errors will indicate the line number. Line numbers can be viewed by clicking on a particular line of the input and viewing the lower left corner of the window.

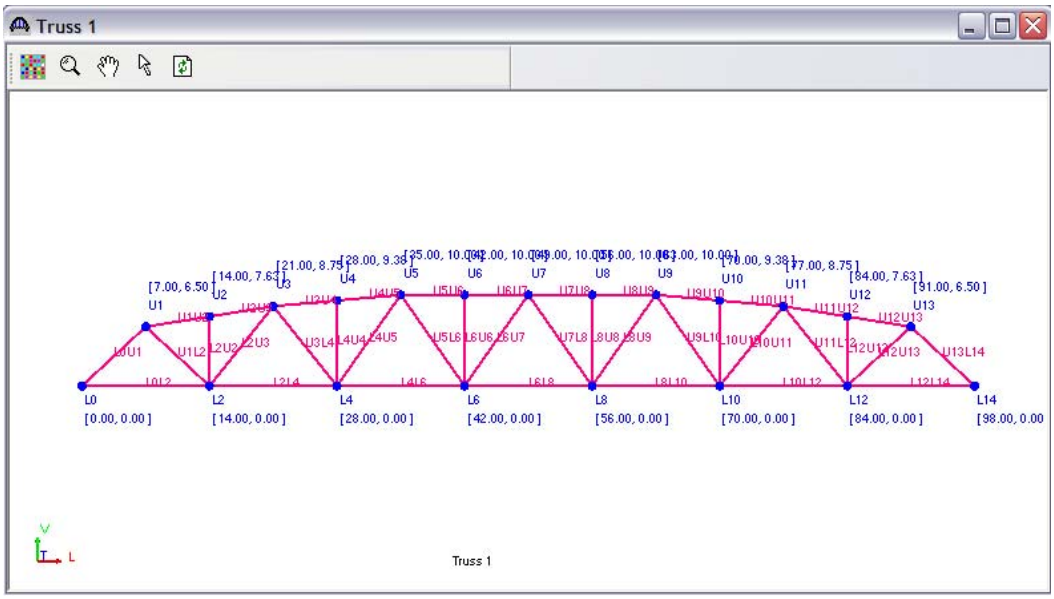
Left click **Close**.

The input for the truss is complete. Left click **OK** to accept and close.

At this point, the user can view a schematic of the truss to help verify the input.




Right click **Truss 1** and left click **Schematic**.



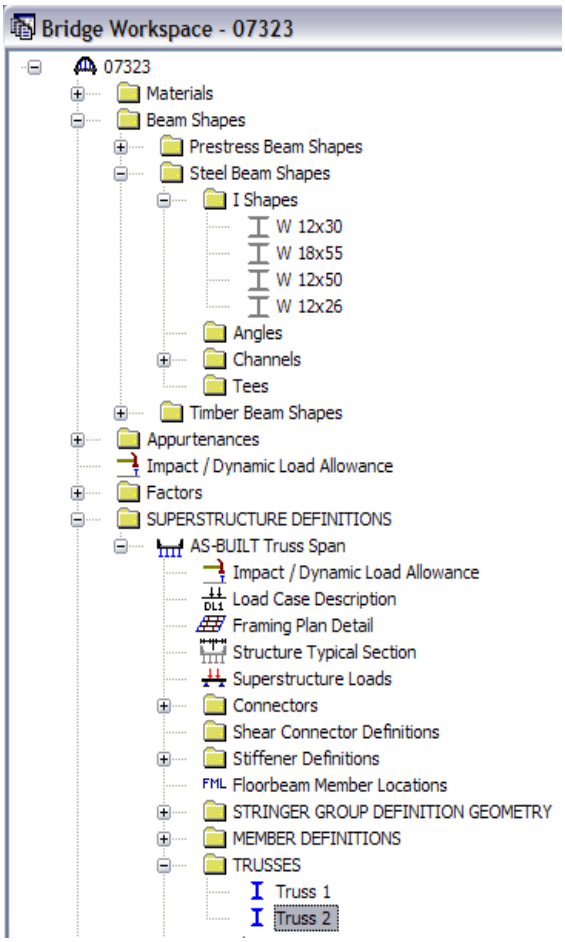

The schematic of the truss will appear and can be compared to the plans.

## LINKING TRUSSES

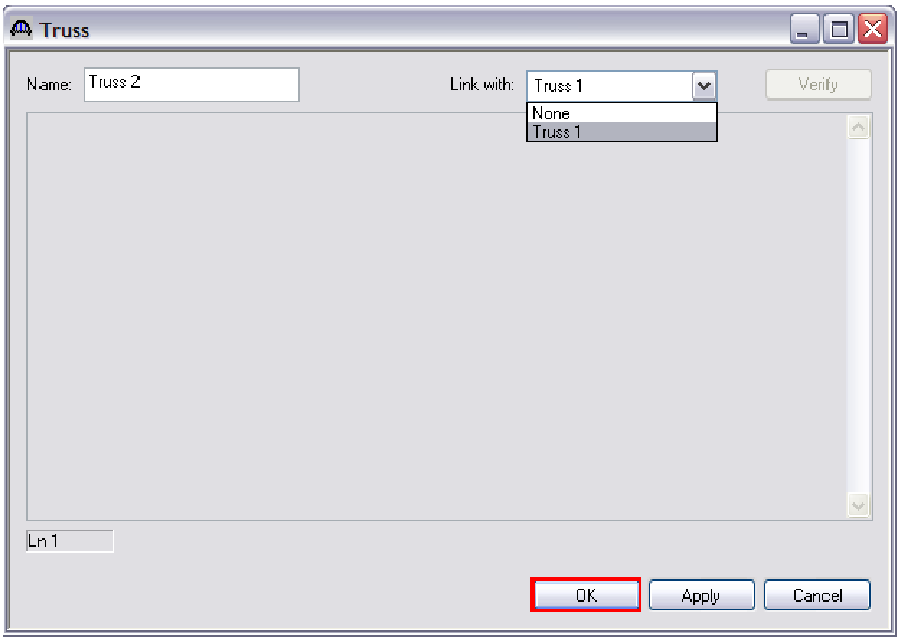
Both truss lines need to be defined. For this example, there is no deterioration and both truss lines are the same. Therefore, link the trusses.

However, if the second truss line had deterioration different from the first, input for the second truss would need to be repeated and modified as necessary. In this situation, the user can copy the truss language from the truss input command window from Truss 1 to Truss 2 using the following process:

1. Open the truss input command window for Truss 1.
2. Highlight all of the information.
3. Hit Ctrl + C to copy the highlighted information.
4. Close the input command window for Truss 1 and open truss command window for Truss 2.
5. Hit Ctrl + V to paste the information from Truss 1 into Truss 2.
6. Modify this information as required.



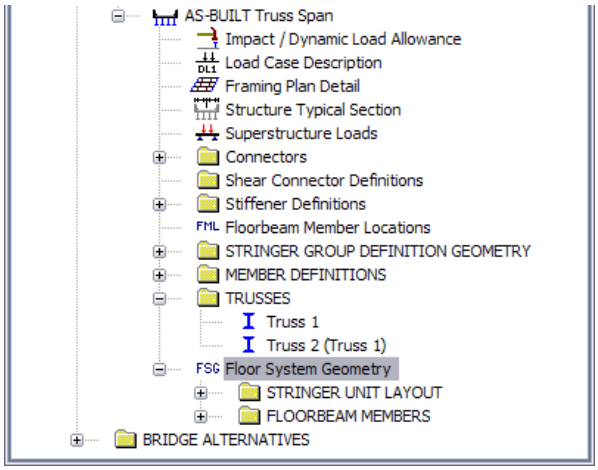

For this example, double click **Truss 2**.




Select **Truss 1** from the **Link with:** drop down menu.

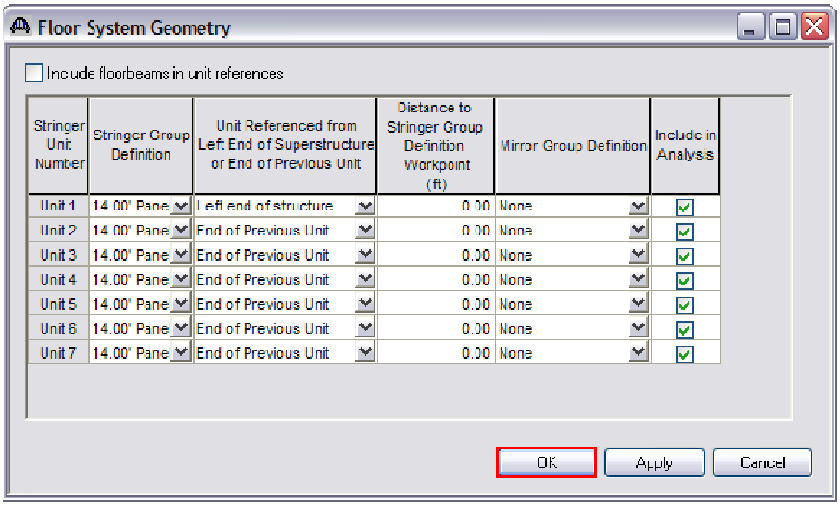
Left click **OK** to accept and close.

## FLOOR SYSTEM GEOMETRY




Double click **Floor System Geometry**.

This window allows you to assign stringer group definitions to stringer units in a floor system superstructure definition. All stringer members have a length of zero and are located at the start of the superstructure prior to entering data in this window. Once stringer group definitions are assigned to stringer units in this window, all stringer members will have a length and location as specified by the stringer group definition assigned to the stringer unit.


Floor System Geometry
Include floorbeams in unit references
Stringer Unit Number
Stringer Group Definition
Unit Referenced from Left End of Superstructure or End of Previous Unit
Distance to Stringer Group Definition Workpoint (ft)
Mirror Group Definition
Include in Analysis
Unit 1 14.00' Panel Left end of structure 0.00 None
Unit 2 14.00' Panel End of Previous Unit 0.00 None
Unit 3 14.00' Panel End of Previous Unit 0.00 None
Unit 4 14.00' Panel End of Previous Unit 0.00 None
Unit 5 14.00' Panel End of Previous Unit 0.00 None
Unit 6 14.00' Panel End of Previous Unit 0.00 None
Unit 7 14.00' Panel End of Previous Unit 0.00 None
OK
Apply
Cancel

**Include floorbeams in unit references** Checkbox: Leave the box unchecked since Floorbeam0 and Floorbeam7 are fictitious as the stringers rest directly on the abutment.

Virtis will still calculate loads and distribute them accordingly. However, Floorbeam0 and Floorbeam7 will not be included in the rating results.

**Stringer Group Definition:** Select **14.00' Panel** for each stringer unit.

**Unit Referenced from Left End of Superstructure or End of Previous Unit:** Select **Left End of Structure** for Unit 1 and **End of Previous Unit** for all other stringer units.

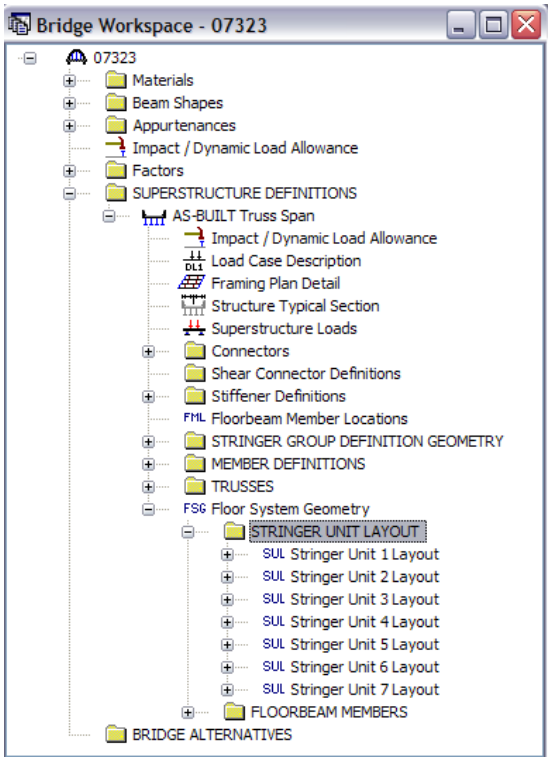
**Distance to Stringer Group Definition Workpoint:** Enter the distance from the reference point selected in the **Unit Referenced from**… column to the work point of the stringer group definition. The work point of a stringer group definition is the intersection of the superstructure definition reference line and the first floorbeam of the stringer group definition assigned to this unit. For this example, enter **0.00 ft** for each row.

**Mirror Group Definition:** Select None for all stringer units. Refer to the Virtis/Opis Help screen for situations when mirroring is useful.

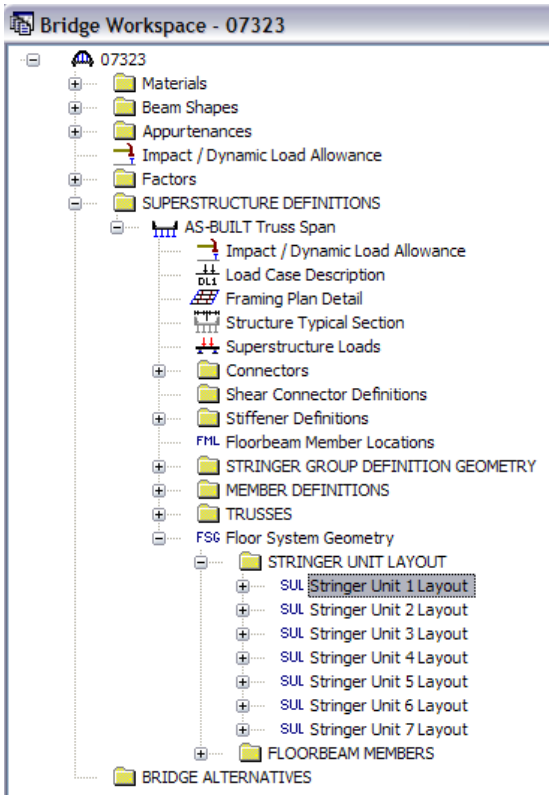
**Include in Analysis:** Since all stringers are to be included in the analysis, check each box.

Left click **OK** to accept and close.

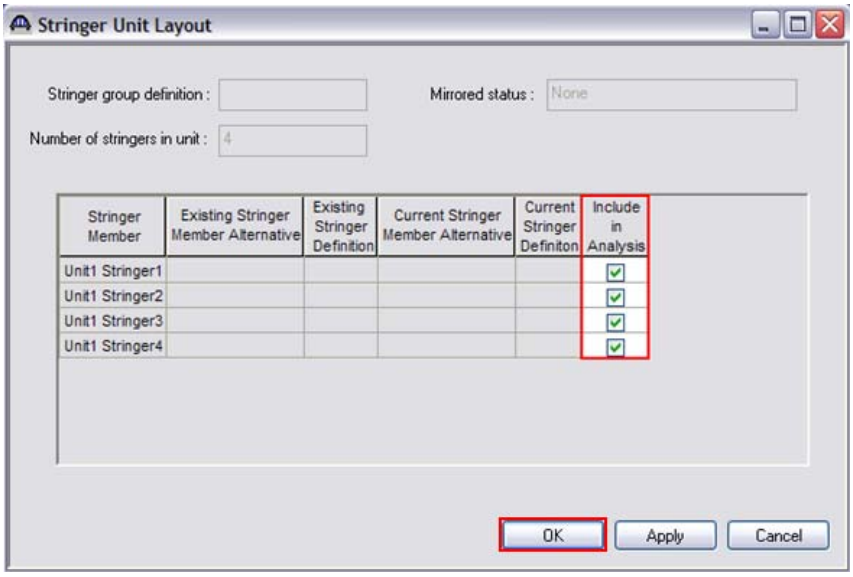
## STRINGER UNIT LAYOUT




Expand the **STRINGER UNIT LAYOUT** folder.




Double click **Stringer Unit 1 Layout**.

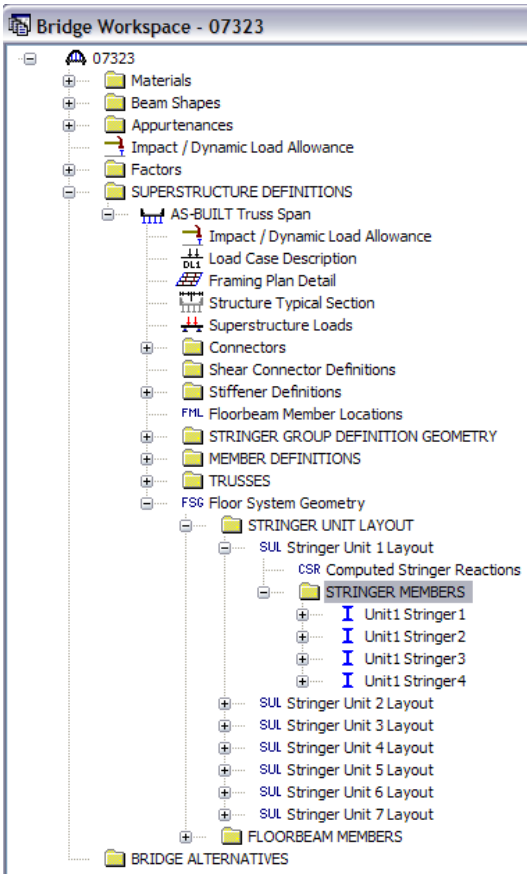



Ensure that all the boxes in the **Include in Analysis** column for each stringer are checked

Left click **OK** to accept and close.

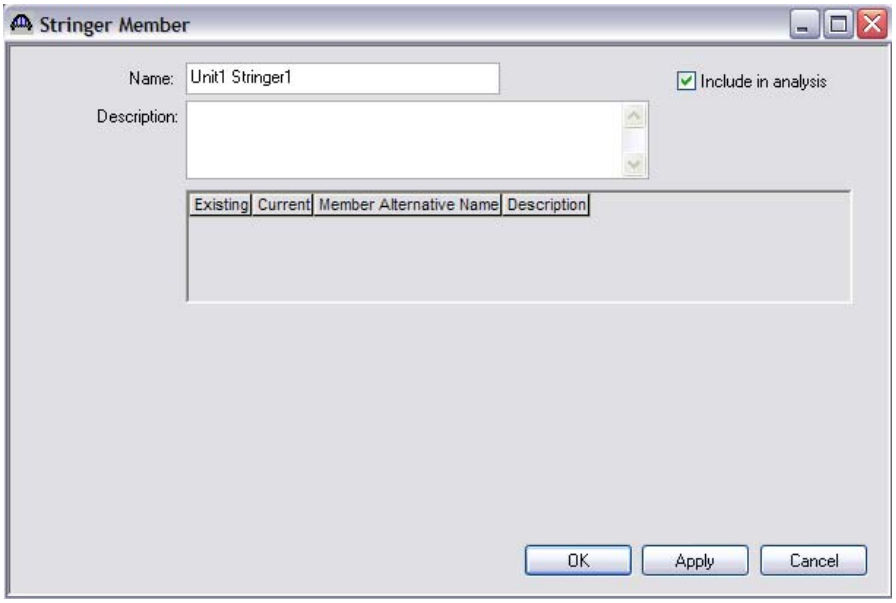
Repeat for Stringer Units 2 through 7.

## STRINGER MEMBERS AND STRINGER MEMBER ALTERNATIVES

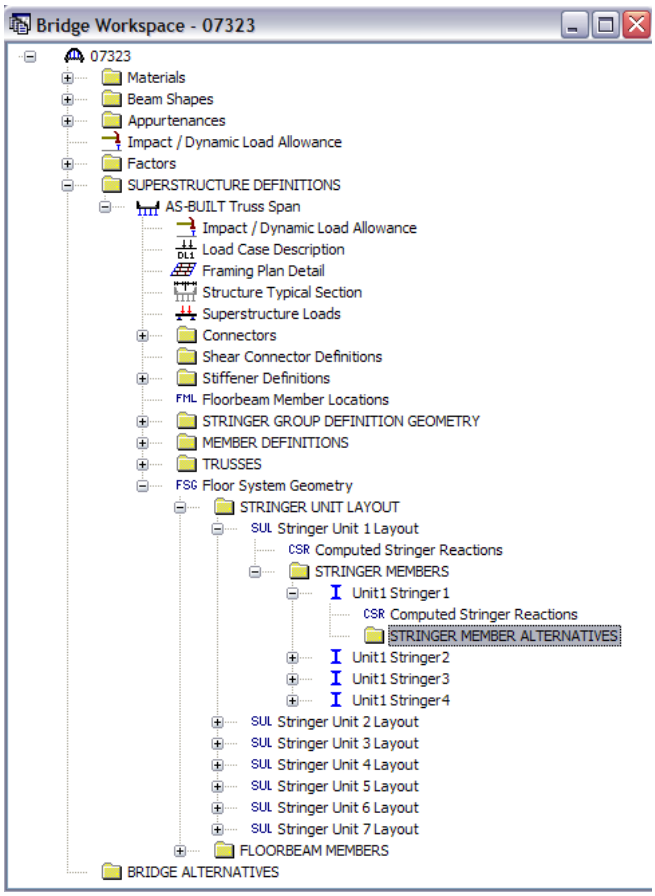



Stringer Members are automatically created by Virtis based on previous input.

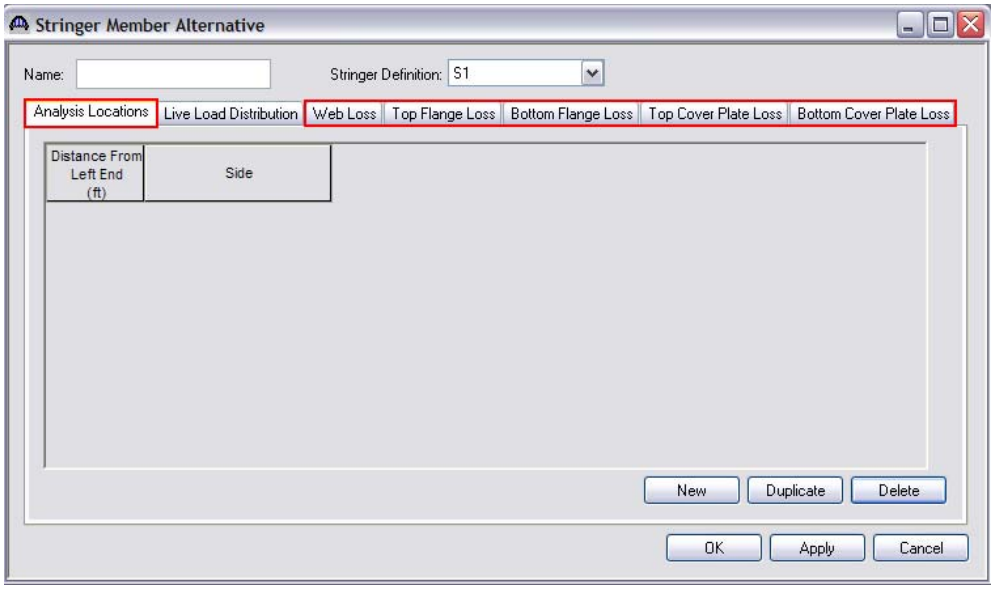
Double click **Unit 1 Stringer 1**.



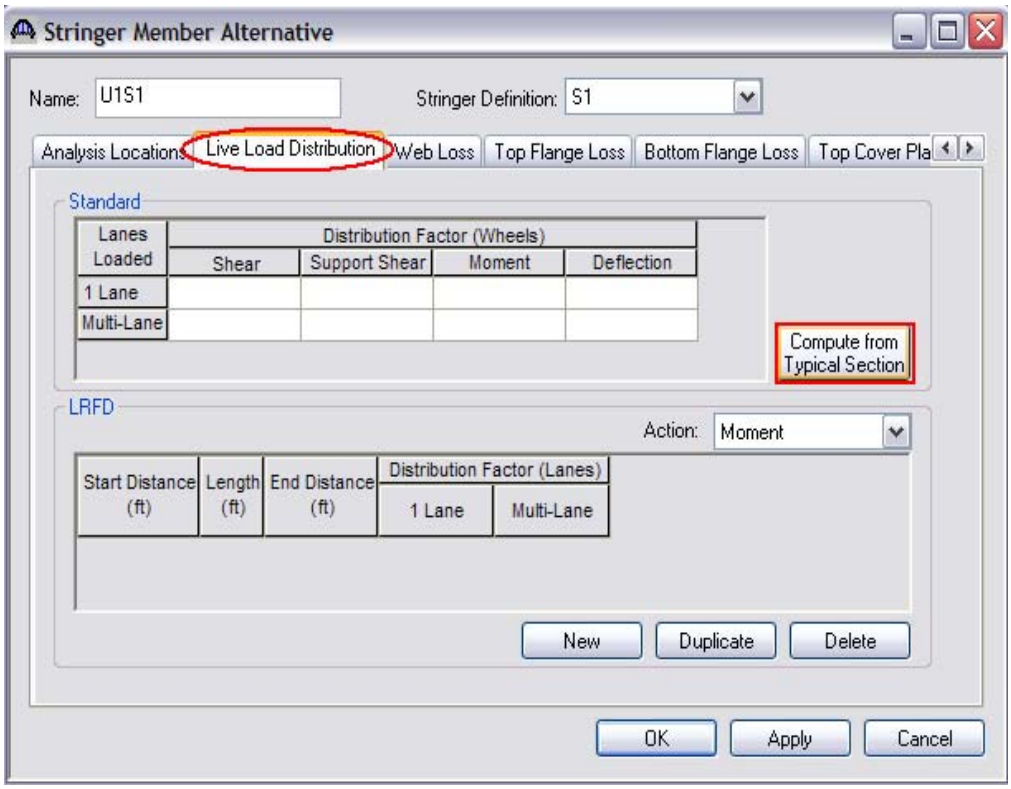

Ensure that the **Include in analysis** box is checked. Otherwise, no input is required for this screen.




Expand **Unit 1 Stringer 1** and double click the **STRINGER MEMBER ALTERNATIVES** folder.




Since there is no deterioration on any of the stringers, the **Analysis Locations** and **Loss** tabs will not be used for the example.

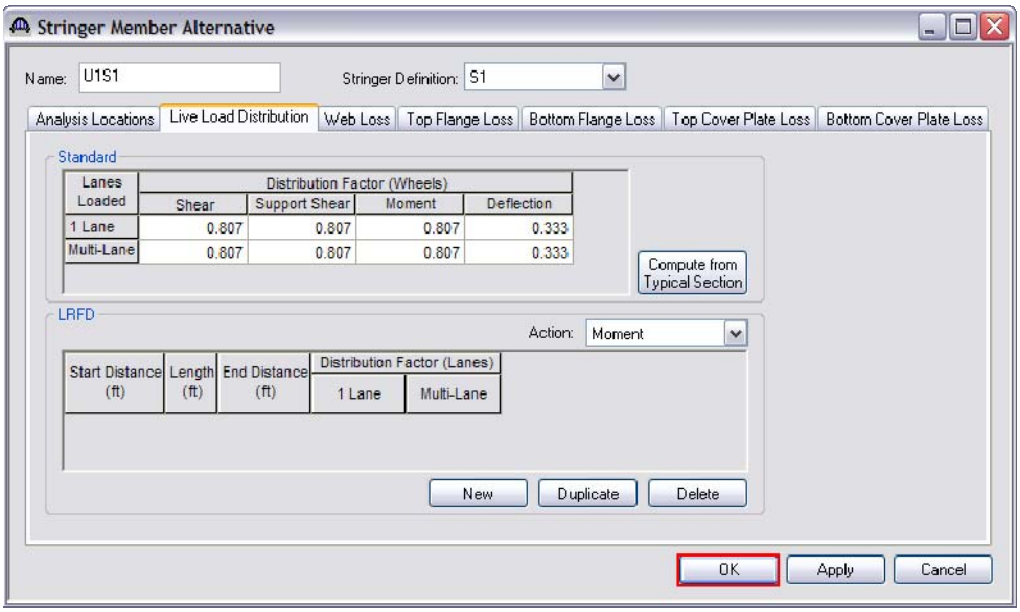



**Live Load Distribution** Tab:

**Name:** U1S1 (i.e. Unit 1 Stringer 1)

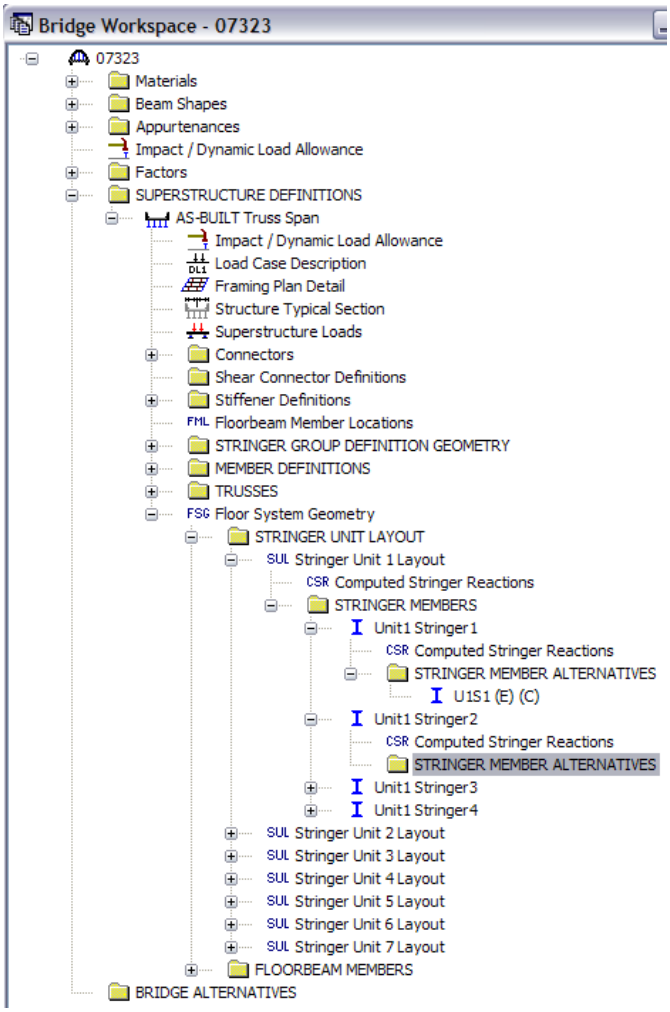
**Stringer Definition:** Select the appropriate stringer definition. S1 is the only available stringer definition.

Left click the **Compute from Typical Section button**.

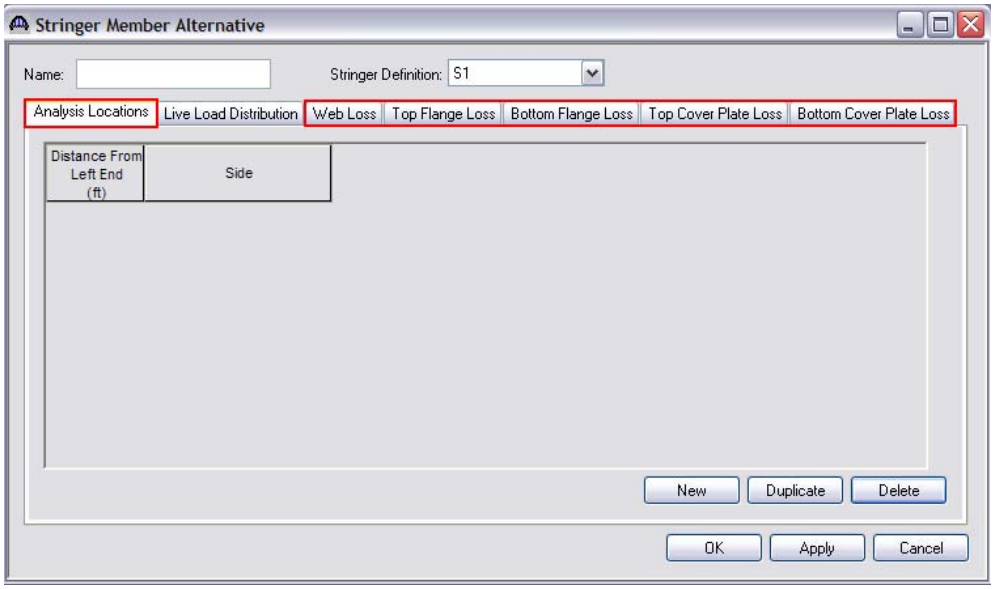



**Note:** The LRFD distribution factors are not needed since the truss can only be analyzed using the LFD module.

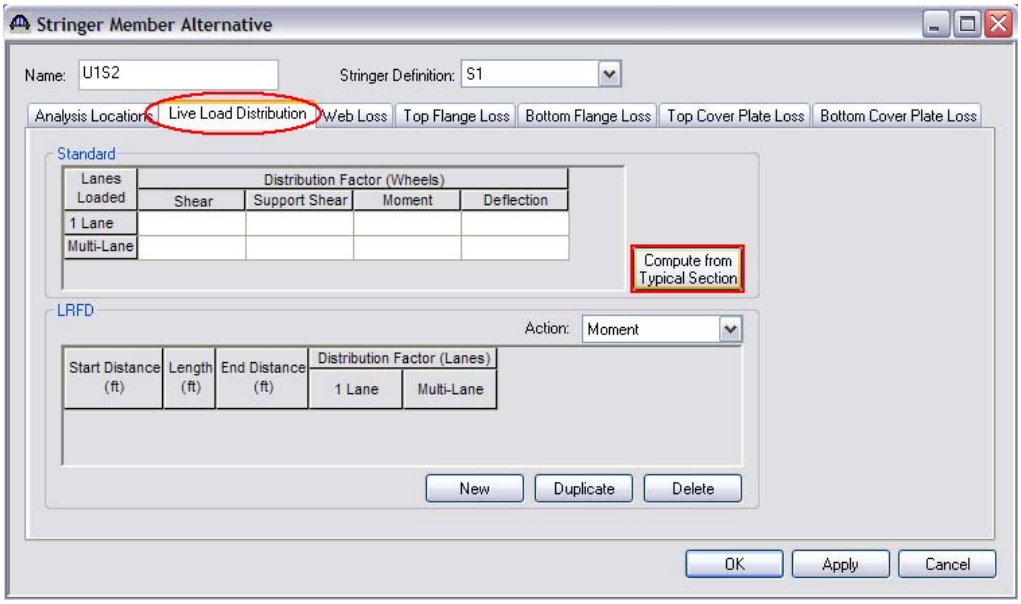
Left click **OK** to accept and close.




Expand **Unit 1 Stringer 2** and double click the **STRINGER MEMBER ALTERNATIVES** folder.



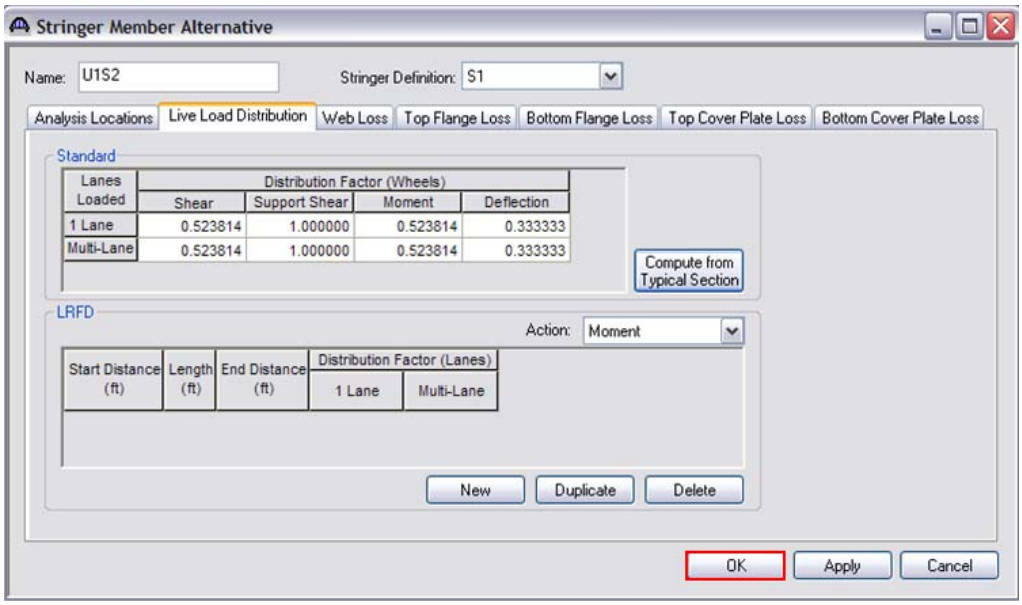

Since there is no deterioration on any of the stringers, the **Analysis Locations** and **Loss** tabs will not be used for the example.



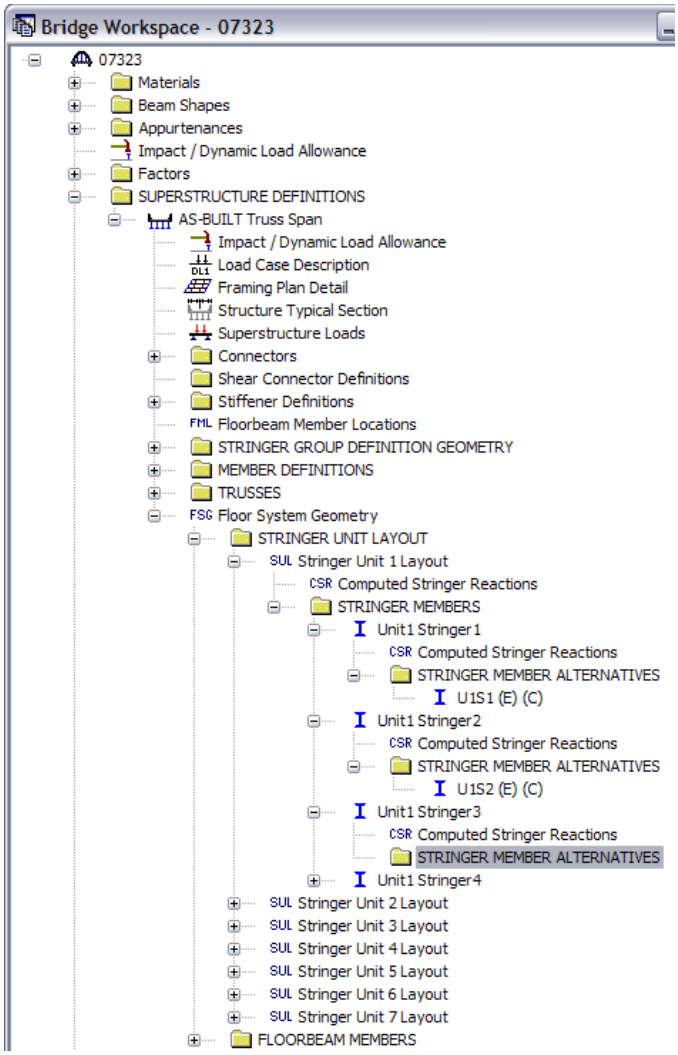

**Live Load Distribution** Tab:

**Name:** U1S2 (i.e. Unit 1 Stringer 2)

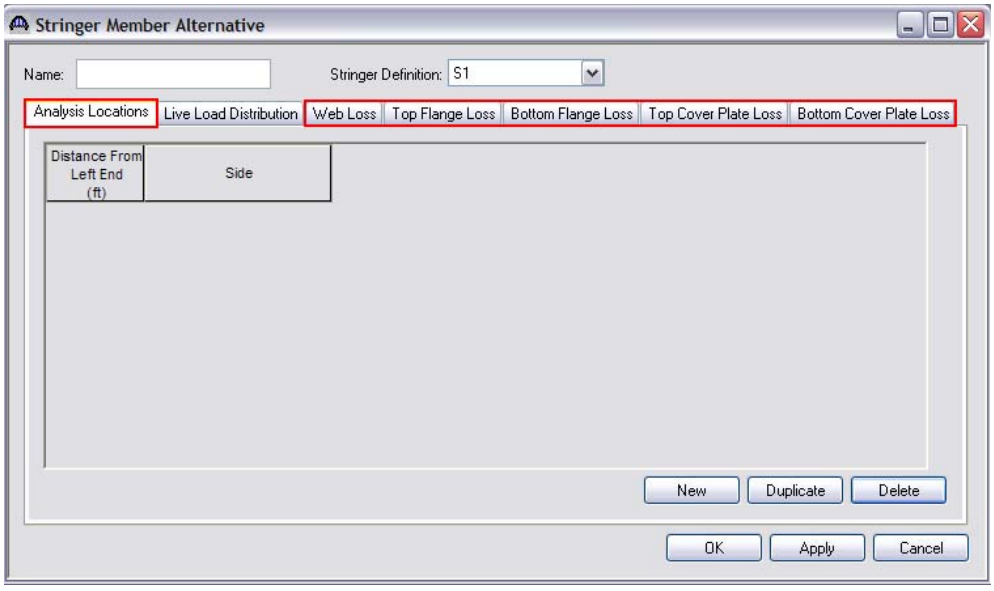
Left click the **Compute from Typical Section button**.



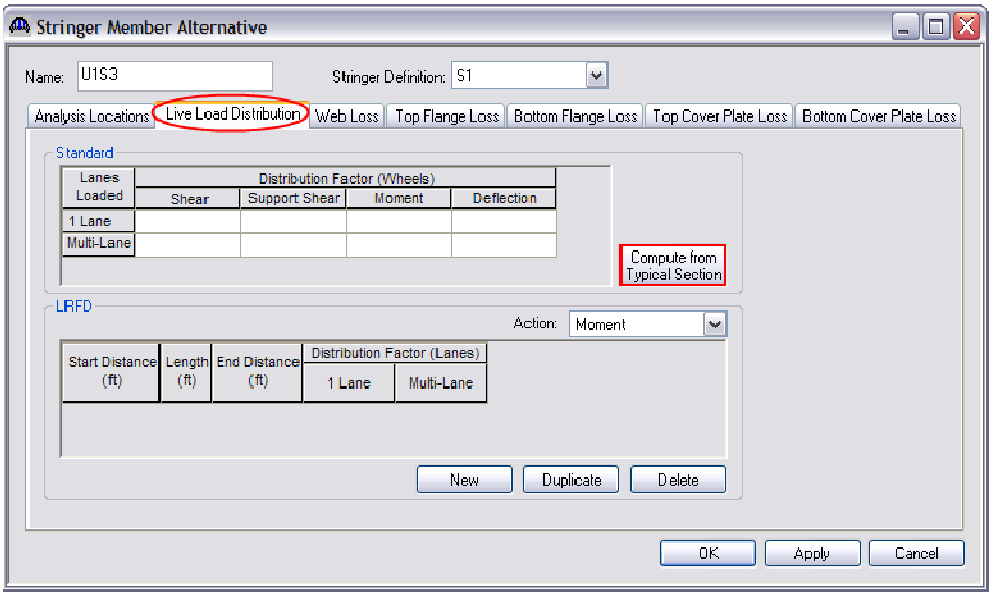

Left click **OK** to accept and close.




Expand **Unit 1 Stringer 3** and double click the **STRINGER MEMBER ALTERNATIVES** folder.



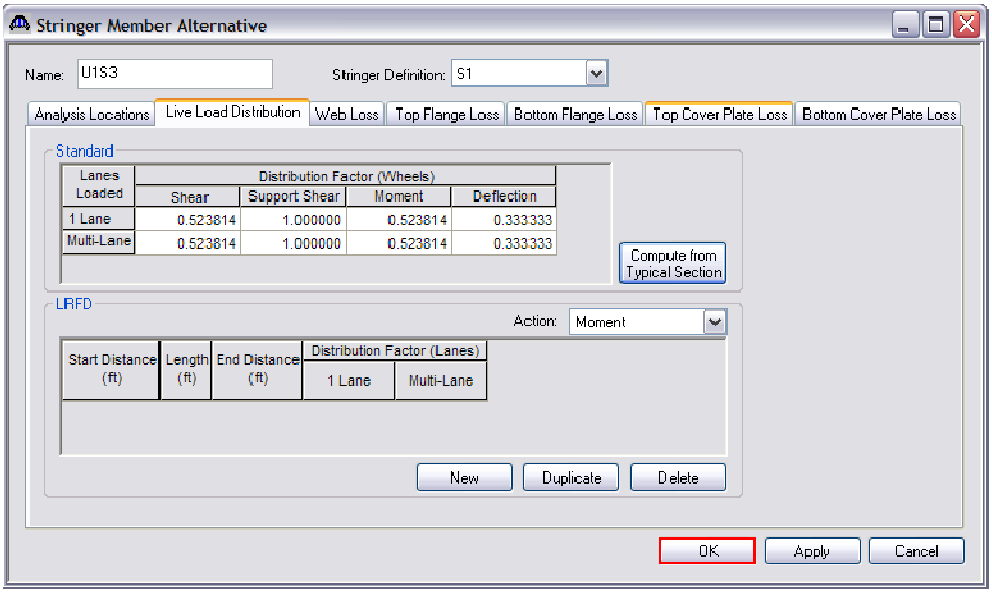

Since there is no deterioration on any of the stringers, the **Analysis Locations** and **Loss** tabs will not be used for the example.



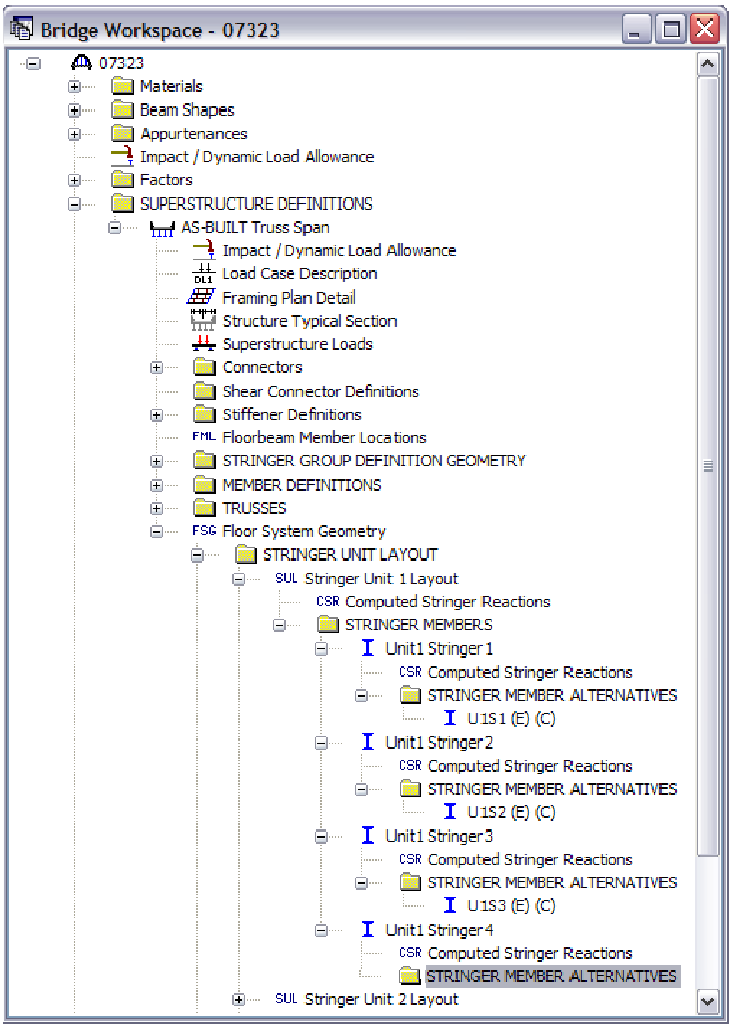

**Live Load Distribution** Tab:

**Name:** U1S3 (i.e. Unit 1 Stringer 3)

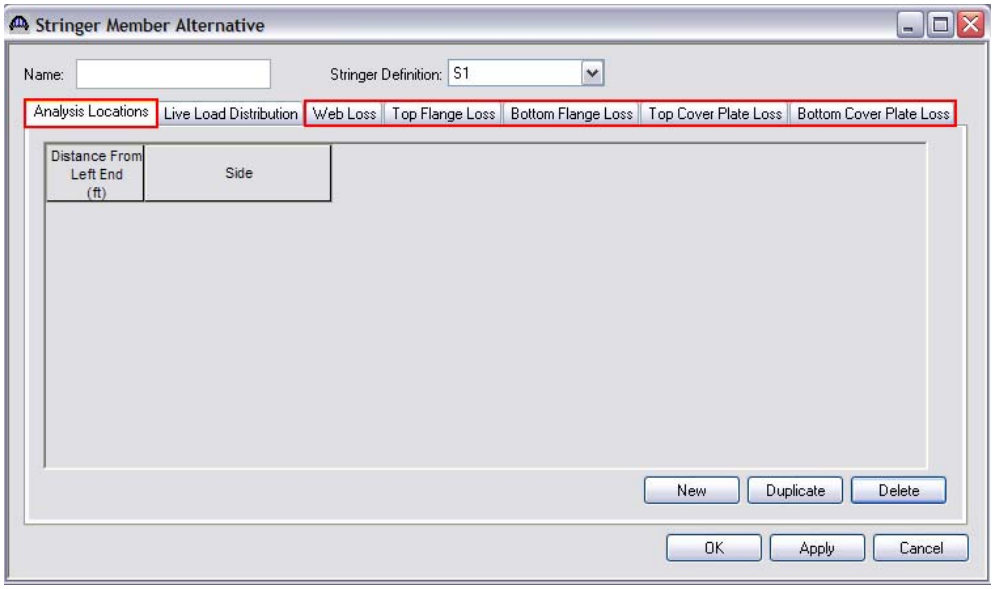
Left click the **Compute from Typical Section button**.



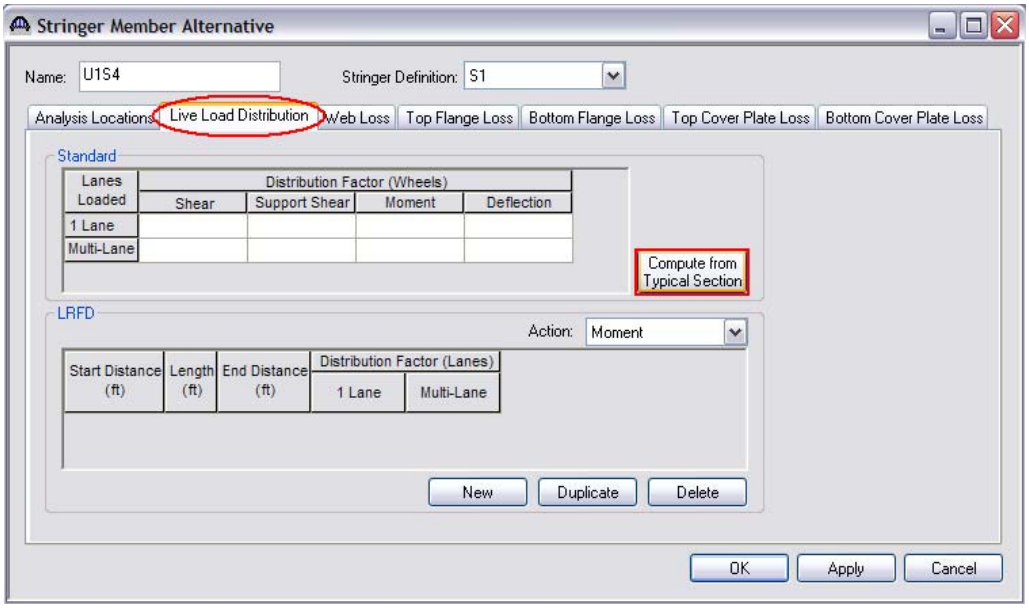

Left click **OK** to accept and close.




Expand **Unit 1 Stringer 4** and double click the **STRINGER MEMBER ALTERNATIVES** folder.



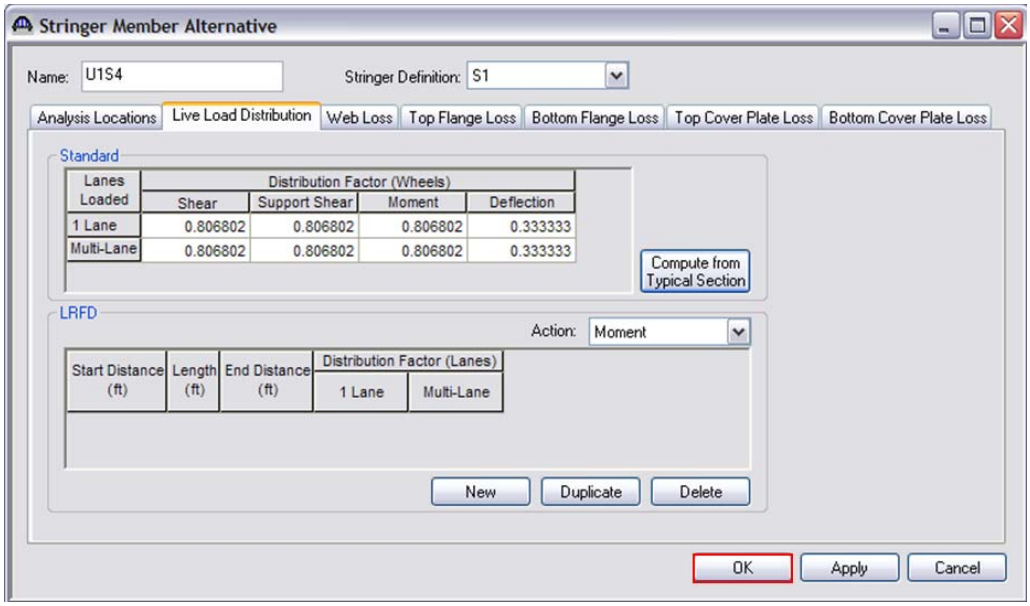

Since there is no deterioration on any of the stringers, the **Analysis Locations** and **Loss** tabs will not be used for the example.




**Live Load Distribution** Tab:

**Name:** U1S4 (i.e. Unit 1 Stringer 4)

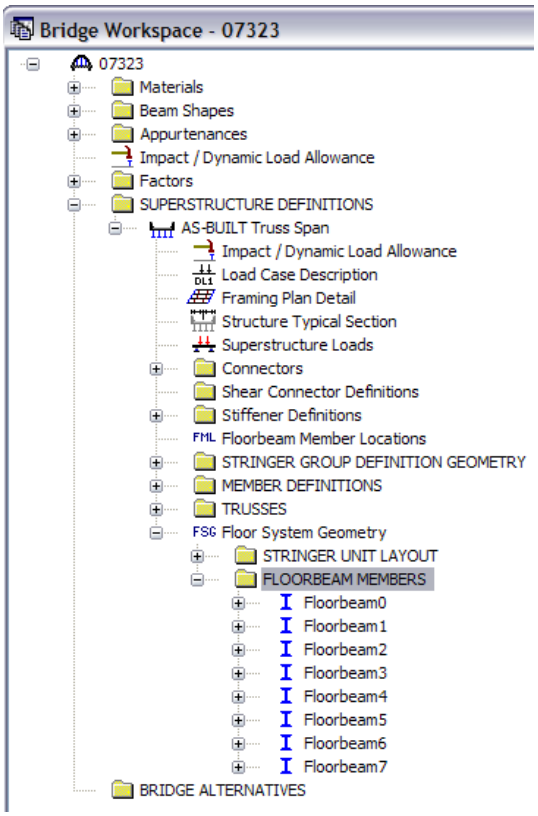
Left click the **Compute from Typical Section button**.




Left click **OK** to accept and close.

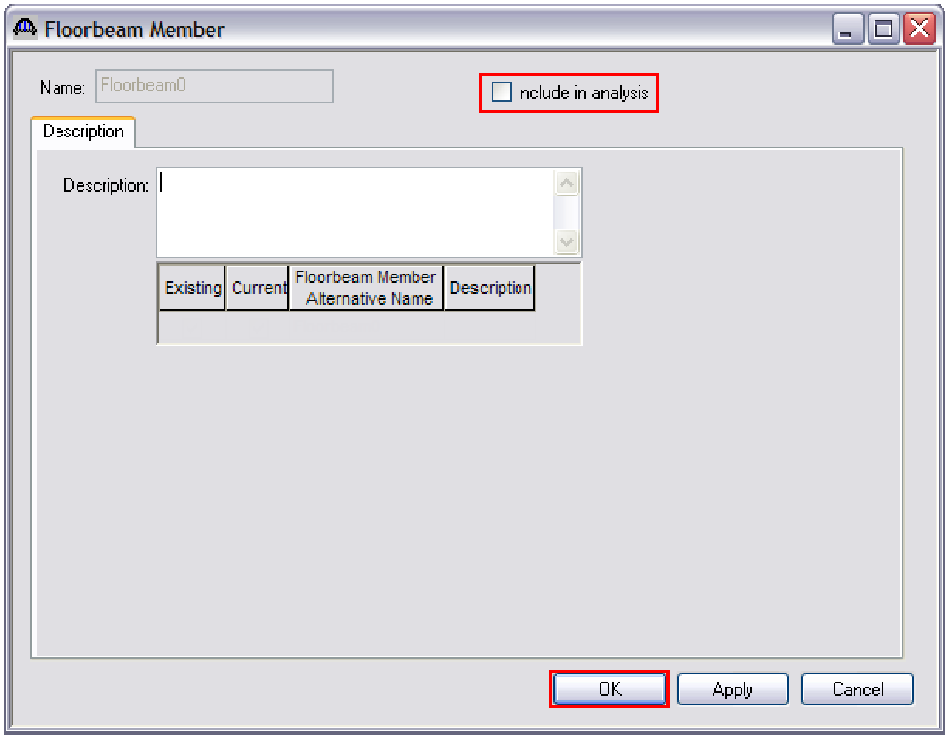
*****Repeat this process for all other Stringer Unit Layouts (2 through 7).**

## FLOORBEAM MEMBERS




Expand the **FLOORBEAM MEMBERS** folder. Floorbeam members are automatically created by Virtis based on previous input.

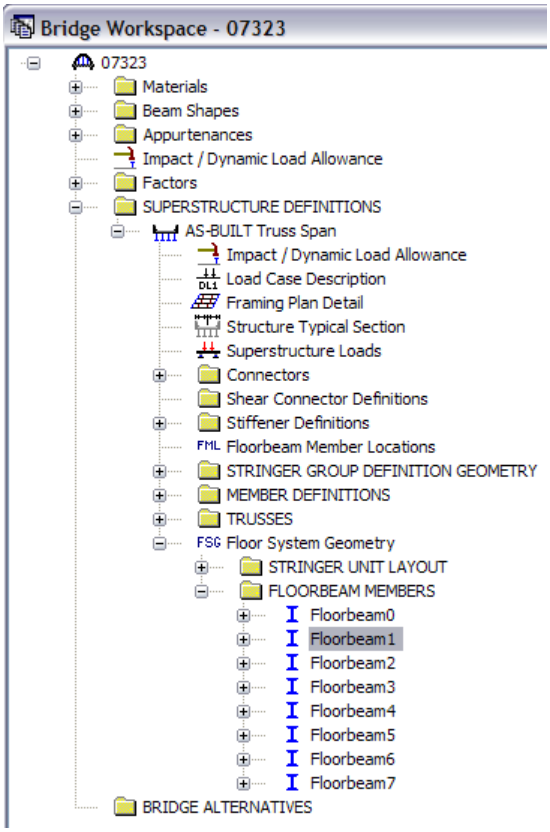
Double click **Floorbeam0**.



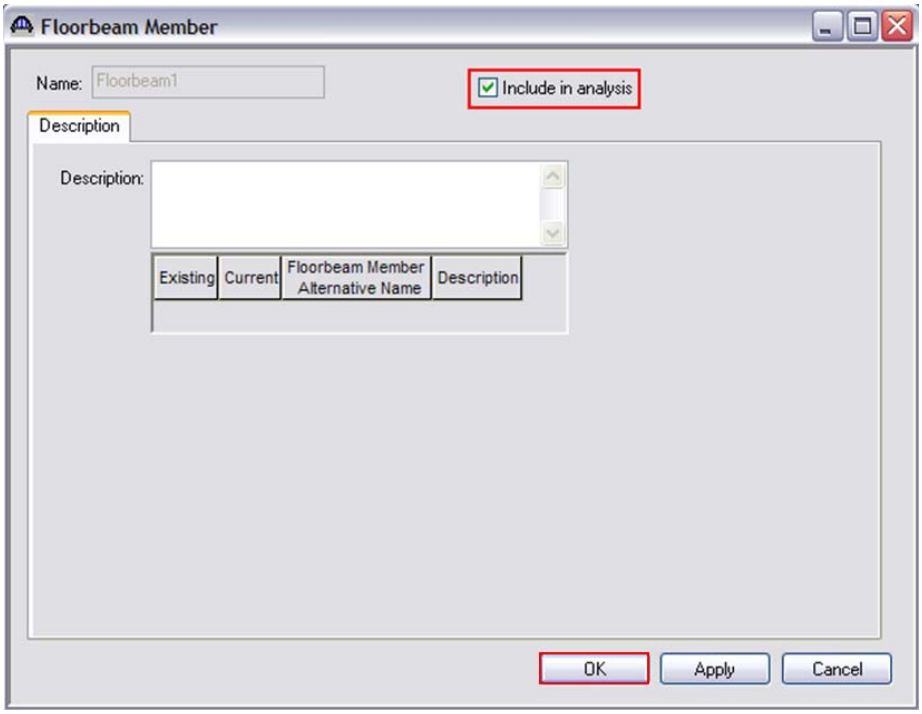

**Include in Analysis Check** Box: Leave the box unchecked since Floorbeam0 is fictitious as the stringers rest directly on the abutment.

Left click **OK** to accept and close.

Repeat this process for **Floorbeam7**.




Double click **Floorbeam1**.

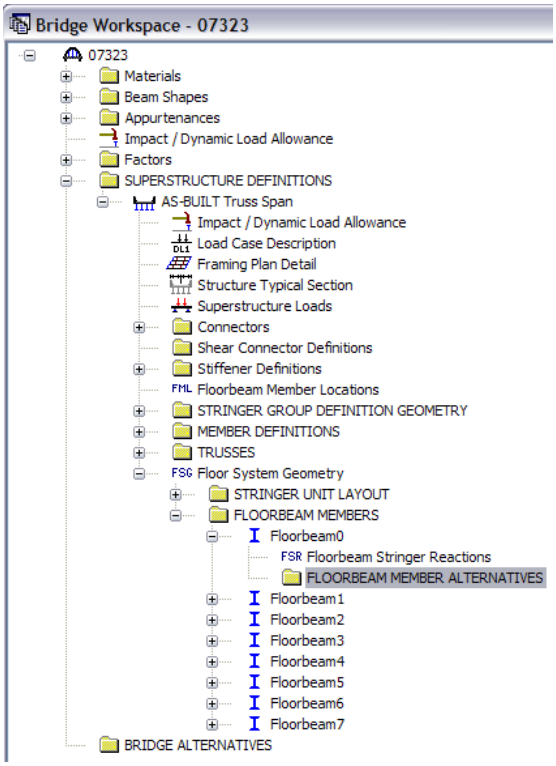



**Include in Analysis Check** Box: Check this box.

Left click **OK** to accept and close.

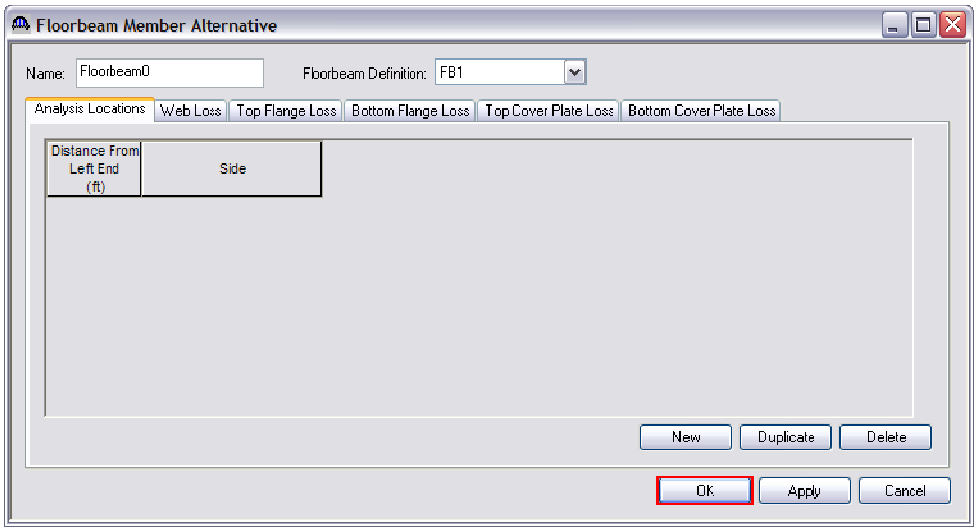
Repeat this process for **Floorbeam2** through **Floorbeam6**.

## FLOORBEAM MEMBER ALTERNATIVES




The user can apply deterioration to the floorbeams in the **Member Alternatives** window.

Expand **Floorbeam0** and double click **FLOORBEAM MEMBER ALTERNATIVES**.




**Name:** Floorbeam0

**Floorbeam Definition:** FB1

Since there is no deterioration to the floorbeam all tabs do not require input.

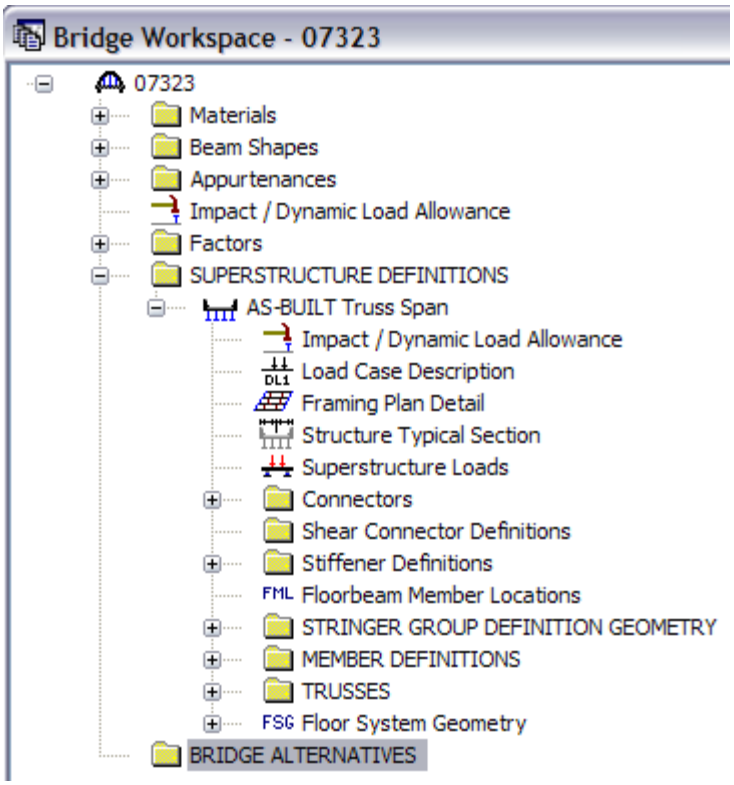
Left click **OK** to accept and close.

*****Repeat this process for Floorbeams 1 through 7.**

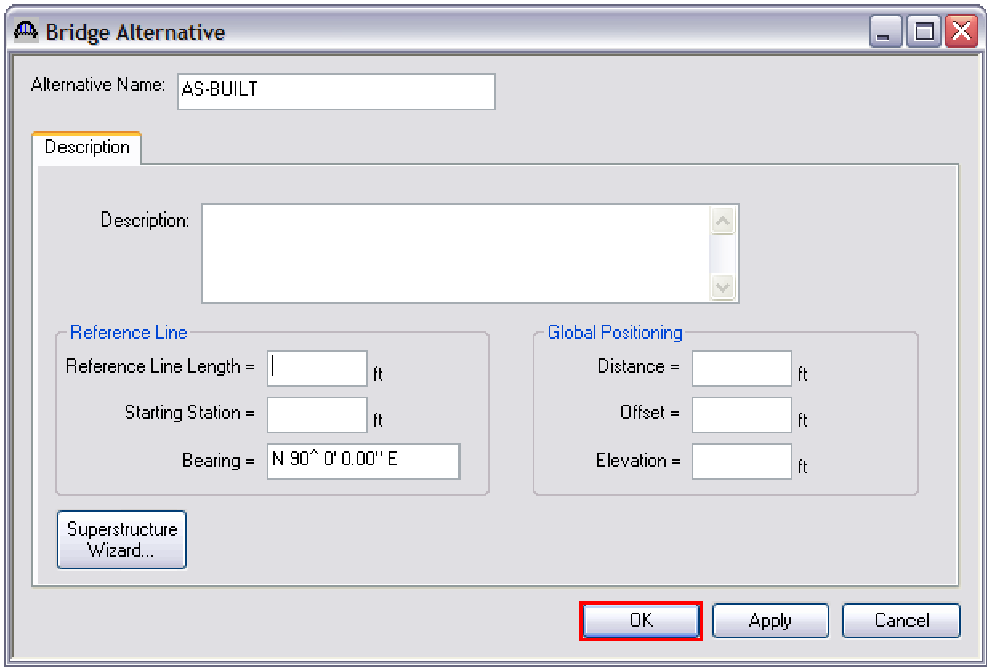
*****THE INPUT FOR THE TRUSS, STRINGERS, AND FLOORBEAMS IS NOW COMPLETE. USER CAN PROCEED TO CREATING THE BRIDGE ALTERNATIVE.**

## CREATING A BRIDGE ALTERNATIVE

A bridge can have several unique bridge alternatives. Each bridge alternative must include the entire bridge but can consist of a different layout of superstructures. The number of spans, the span lengths, and the pier locations are defined within the bridge alternative (and its accompanying windows). Entering different bridge alternatives can be useful when comparing various alternatives for a preliminary study.

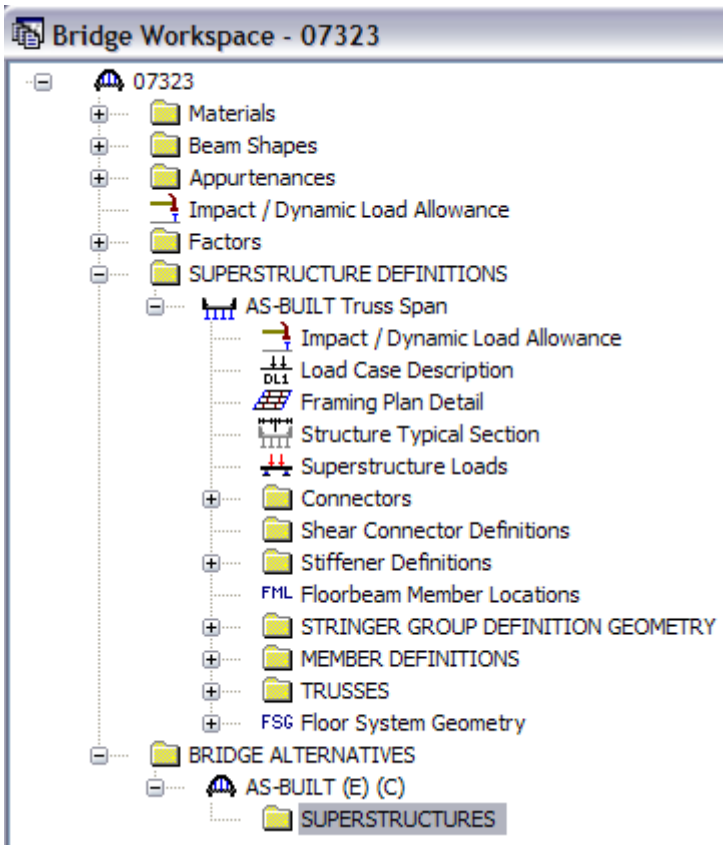



Double click **BRIDGE ALTERNATIVES.**

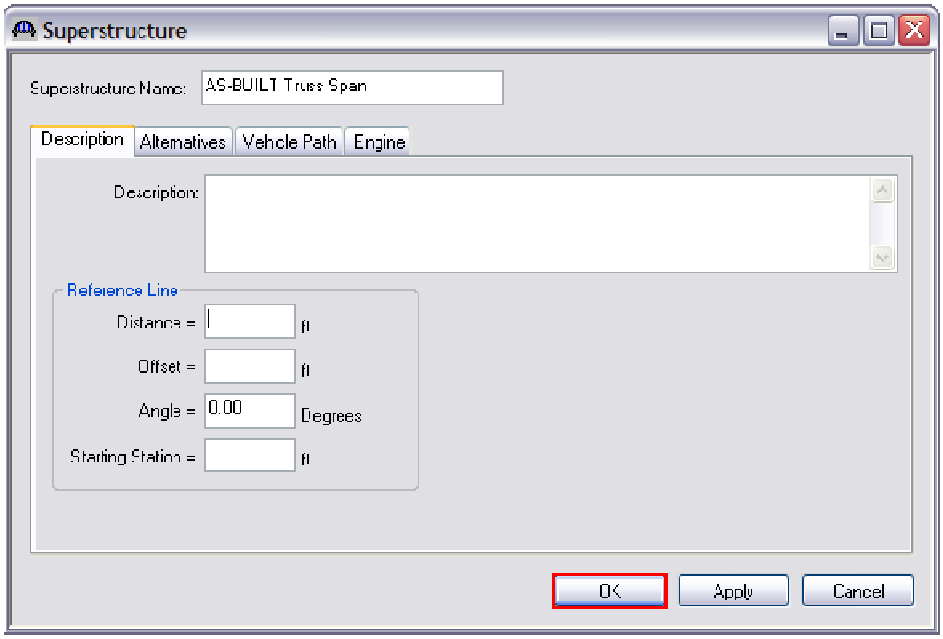



**Alternative Name:** AS-BUILT

Left click **OK** to accept and close.

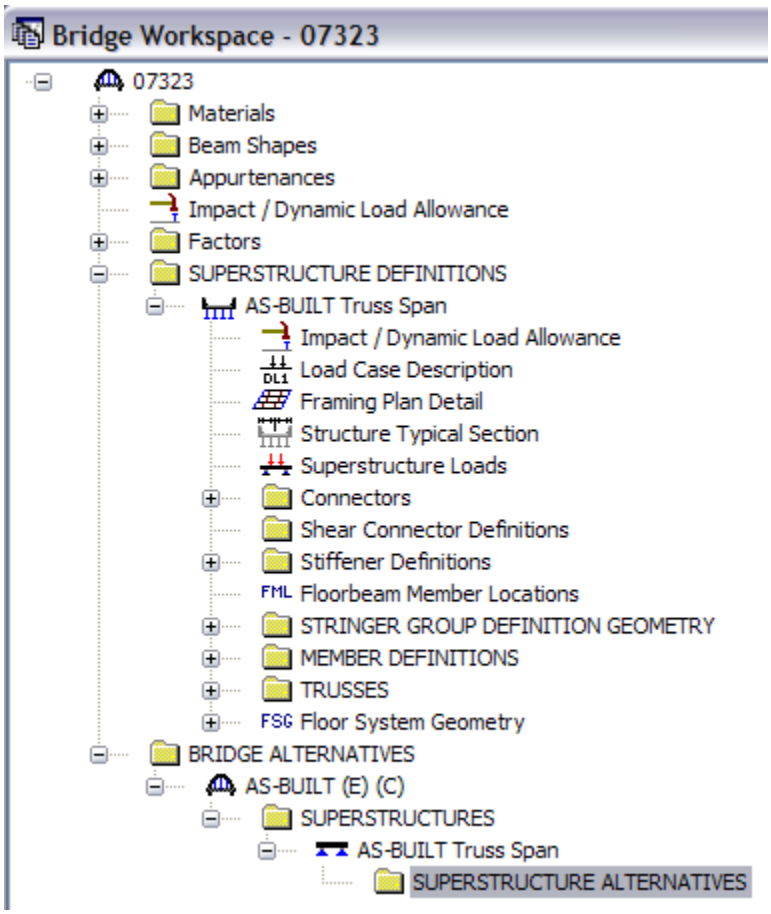



Double click **SUPERSTRUCTURES.**



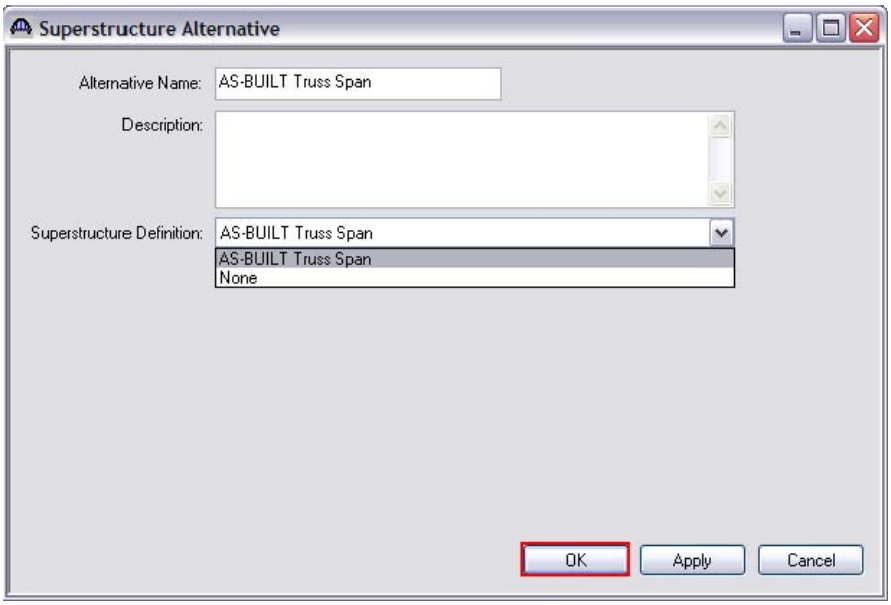

**Superstructure Name:** AS-BUILT Truss Span

Left click **OK** to accept and close.




Expand **AS-BUILT Truss Span**.

Double click **SUPERSTRUCTURE ALTERNATIVES.**




**Alternative Name:** AS-BUILT Truss Span

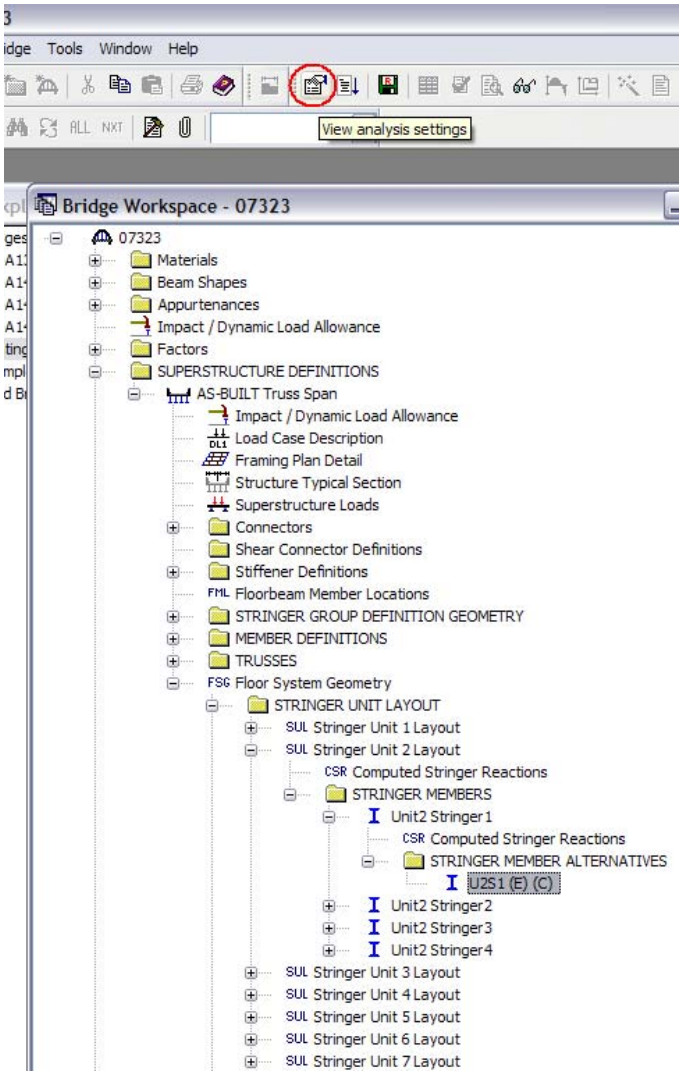
**Superstructure Definition:** Select **AS-BUILT Truss Span** from the drop down menu.

Left click **OK** to accept and close.

*****THE INPUT FOR THE TRUSS SPAN BRIDGE ALTERNATIVE IS COMPLETE.**

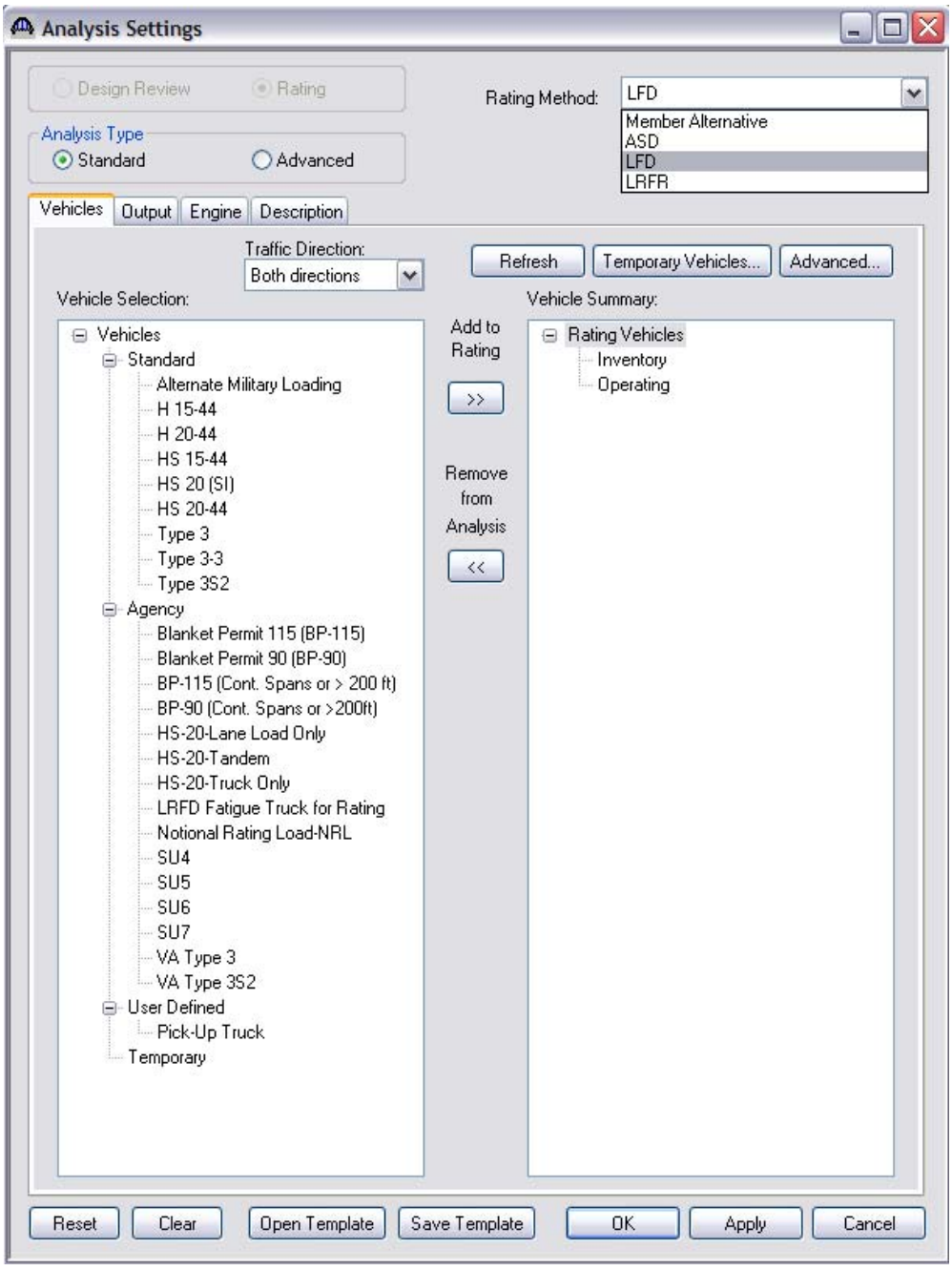
*****THE USER SHOULD NOW REFER TO APPENDIX B AND APPENDIX C TO UPDATE THE PANEL POINT LOAD AND THE ADDITIONAL SELF-LOAD FOR THE TRUSS. ONCE DONE, THE INPUT FOR THE BRIDGE IS NOW COMPLETE.**

## ANALYSIS



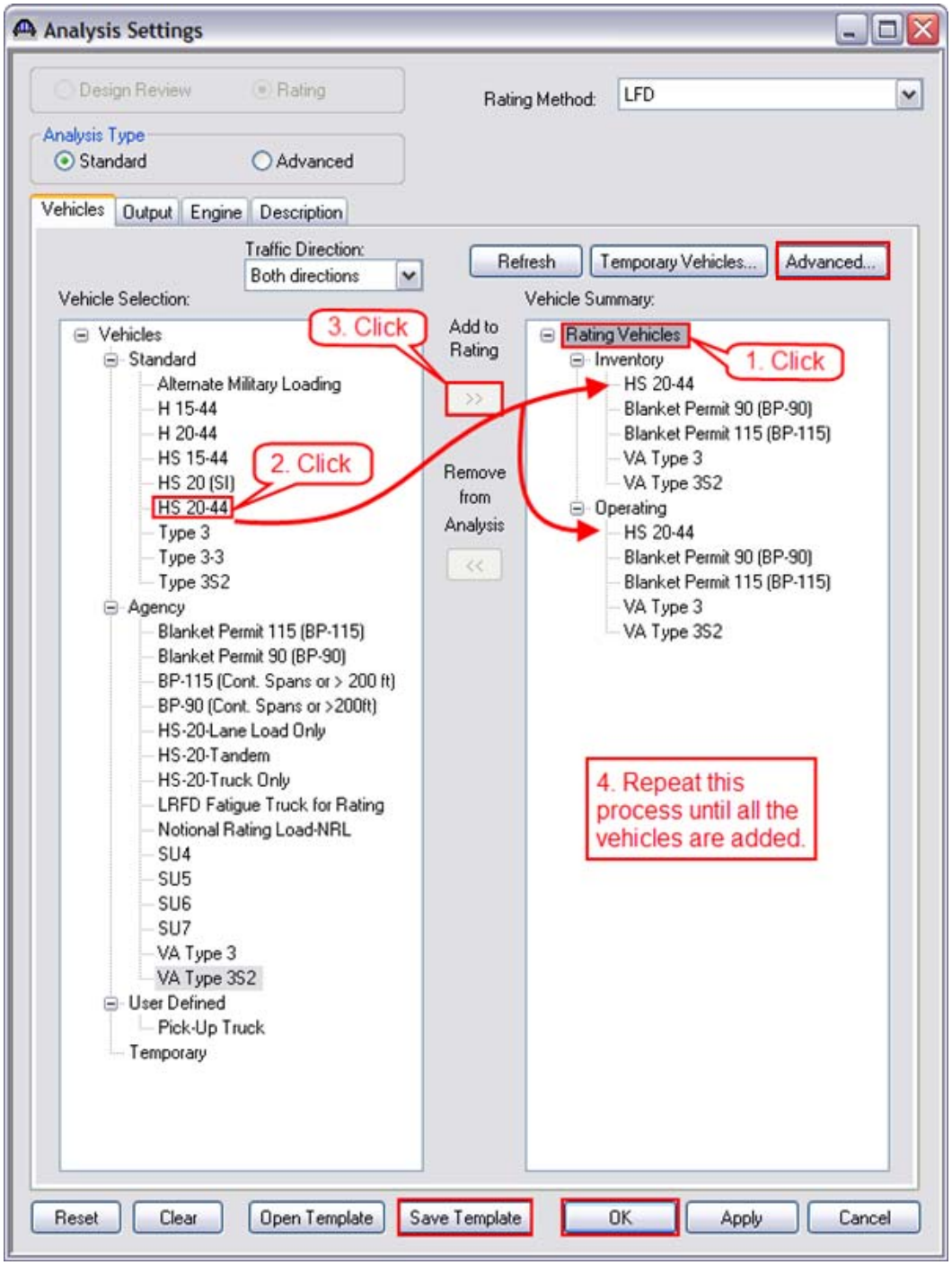

The file is now ready to be analyzed. The user can either analyze individual beams with the file open or analyze the entire bridge with the file closed.

To analyze an individual member, highlight the **MEMBER ALTERNATIVE** of interest and left click the **View Analysis Settings Icon**.




The **Analysis Settings** window will appear. Either open a saved template or follow these steps to create one:

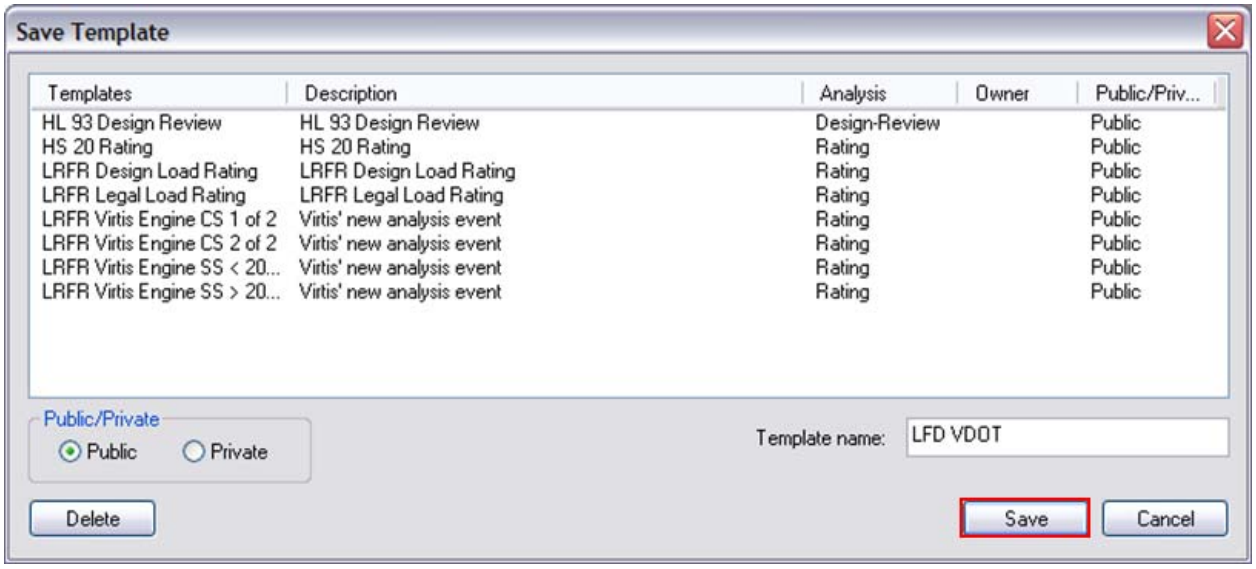
On the **Rating Method** dropdown menu, change the method to **LFD**.




Add the vehicles shown in the screen shot from the **Vehicle Selection** list.

This is done by first left clicking **Rating Vehicles** in the right column. Then, left click the desired vehicle from the left column and left click the **Add to Rating >>** Button.

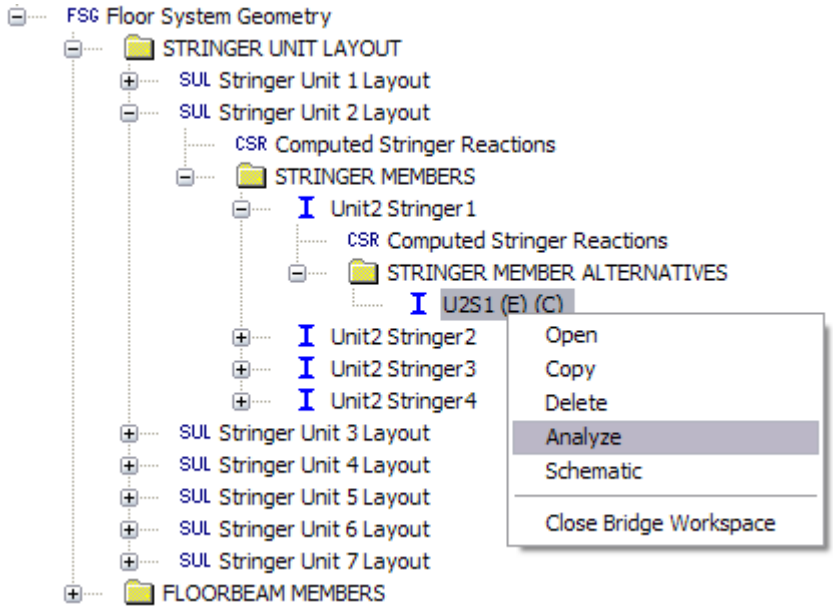
This can be saved as a Template for future ratings. Left click the **Save Template** button to open the **Save Template** window.



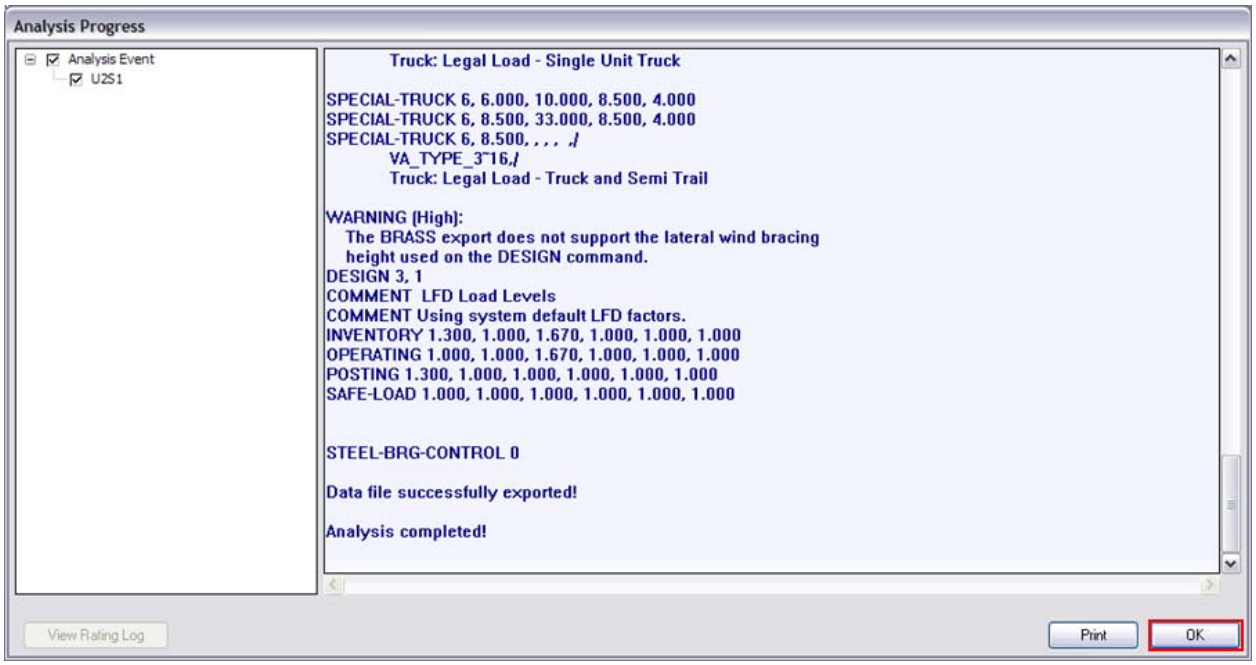

Type **LFD VDOT** for the **Template Name** and left click the **Save** button.

Left click **OK** on the **Analysis Settings** window to accept and close.

## ANALYZE MEMBER



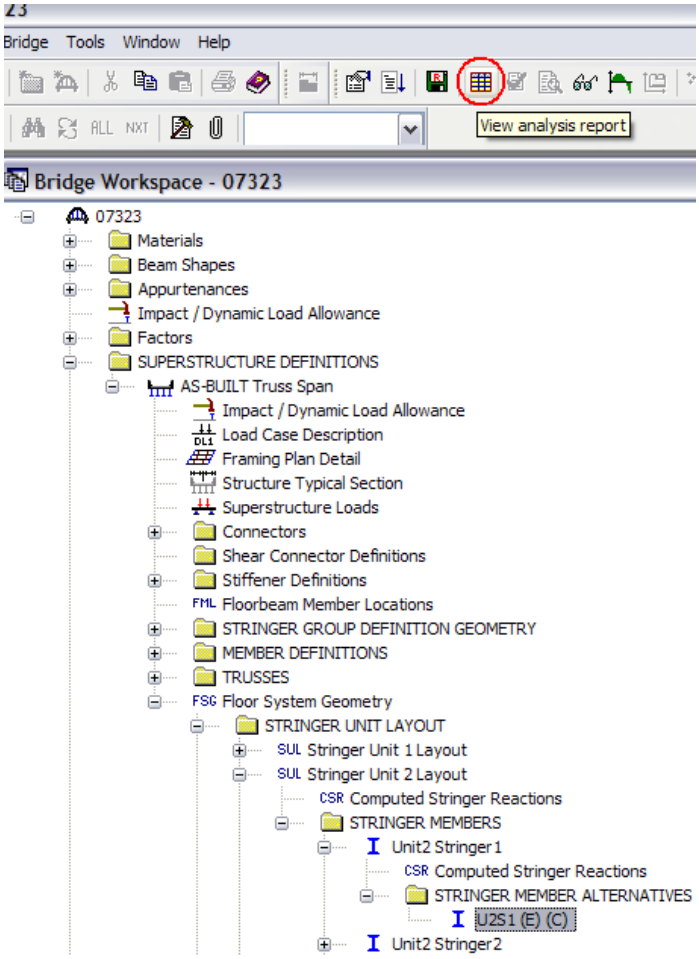

To analyze a specific member, right click the desired **MEMBER ALTERNATIVE** and select **Analyze**.


Analysis Progress
Analysis Event
U2S1
Truck: Legal Load - Single Unit Truck
SPECIAL-TRUCK 6, 6.000, 10.000, 8.500, 4.000
SPECIAL-TRUCK 6, 8.500, 33.000, 8.500, 4.000
SPECIAL-TRUCK 6, 8.500, , , , ,/
VA_TYPE_3~16,/
Truck: Legal Load - Truck and Semi Trail
WARNING (High):
The BRASS export does not support the lateral wind bracing
height used on the DESIGN command.
DESIGN 3, 1
COMMENT LFD Load Levels
COMMENT Using system default LFD factors.
INVENTORY 1.300, 1.000, 1.670, 1.000, 1.000, 1.000
OPERATING 1.000, 1.000, 1.670, 1.000, 1.000, 1.000
POSTING 1.300, 1.000, 1.000, 1.000, 1.000, 1.000
SAFE-LOAD 1.000, 1.000, 1.000, 1.000, 1.000, 1.000
STEEL-BRG-CONTROL 0
Data file successfully exported!
Analysis completed!
View Rating Log
Print
OK

Allow the program to analyze the beam. After the analysis is completed, the user can read any warnings or errors by scrolling up the **Analysis Progress** window.

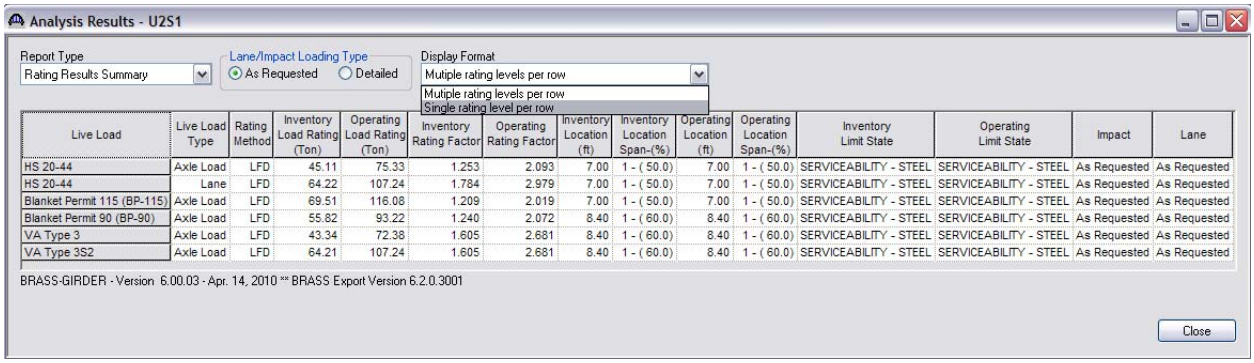
Click **OK** to proceed to view results.

To view the results keep the analyzed **MEMBER ALTERNATIVE** selected.




Left click the **View analysis report** icon.

The **Analysis Results** window will appear. To view a more compact version of the results, select **Single rating level per row** under the Display Format Window.




| Live Load | Live Load Type | Rating Method | Inventory Load Rating (Ton) | Operating Load Rating (Ton) | Inventory Rating Factor | Operating Rating Factor | Inventory Location (ft) | Inventory Location Span-(%) | Operating Location (ft) | Operating Location Span-(%) | Inventory Limit State | Operating Limit State | Impact | Lane |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HS 20-44 | Axle Load | LFD | 45.11 | 75.33 | 1.253 | 2.093 | 7.00 | 1 - ( 50.0) | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STEEL | As Requested | As Requested |
| HS 20-44 | Lane | LFD | 64.22 | 107.24 | 1.784 | 2.979 | 7.00 | 1 - ( 50.0) | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STEEL | As Requested | As Requested |
| Blanket Permit 115 (BP-115) | Axle Load | LFD | 69.51 | 116.08 | 1.209 | 2.019 | 7.00 | 1 - ( 50.0) | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STEEL | As Requested | As Requested |
| Blanket Permit 90 (BP-90) | Axle Load | LFD | 55.82 | 93.22 | 1.240 | 2.072 | 8.40 | 1 - ( 60.0) | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STEEL | As Requested | As Requested |
| VA Type 3 | Axle Load | LFD | 43.34 | 72.38 | 1.605 | 2.681 | 8.40 | 1 - ( 60.0) | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STEEL | As Requested | As Requested |
| VA Type 3S2 | Axle Load | LFD | 64.21 | 107.24 | 1.605 | 2.681 | 8.40 | 1 - ( 60.0) | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STEEL | As Requested | As Requested |

## STRINGER U2S1 RATING RESULTS

Analysis Results - U2S1

Report Type: Rating Results Summary

Lane/Impact Loading Type: (•) As Requested ( ) Detailed

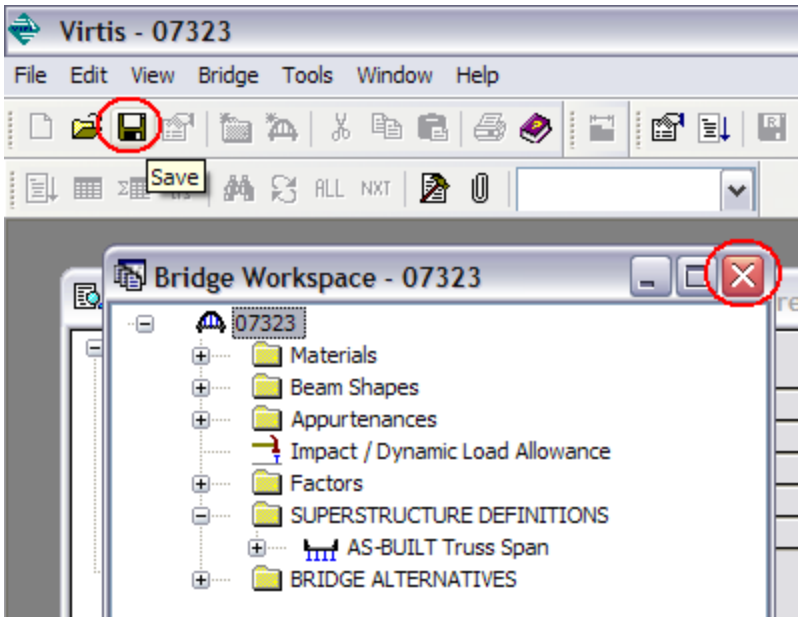
Display Format: Single rating level per row

| Live Load | Live Load Type | Rating Method | Rating Level | Load Rating (Ton) | Rating Factor | Location (ft) | Location Span-(%) | Limit State | Impact | Lane |
|---|---|---|---|---|---|---|---|---|---|---|
| HS 20-44 | Axle Load | LFD | Invent | 45.11 | 1.253 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| HS 20-44 | Axle Load | LFD | Opera | 75.33 | 2.093 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| HS 20-44 | Lane | LFD | Invent | 64.22 | 1.784 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| HS 20-44 | Lane | LFD | Opera | 107.24 | 2.979 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| Blanket Permit 115 (BP-115) | Axle Load | LFD | Invent | 69.51 | 1.209 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| Blanket Permit 115 (BP-115) | Axle Load | LFD | Opera | 116.08 | 2.019 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| Blanket Permit 90 (BP-90) | Axle Load | LFD | Invent | 55.82 | 1.240 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| Blanket Permit 90 (BP-90) | Axle Load | LFD | Opera | 93.22 | 2.072 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| VA Type 3 | Axle Load | LFD | Invent | 43.34 | 1.605 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| VA Type 3 | Axle Load | LFD | Opera | 72.38 | 2.681 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| VA Type 3S2 | Axle Load | LFD | Invent | 64.21 | 1.605 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested |
| VA Type 3S2 | Axle Load | LFD | Opera | 107.24 | 2.681 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested |

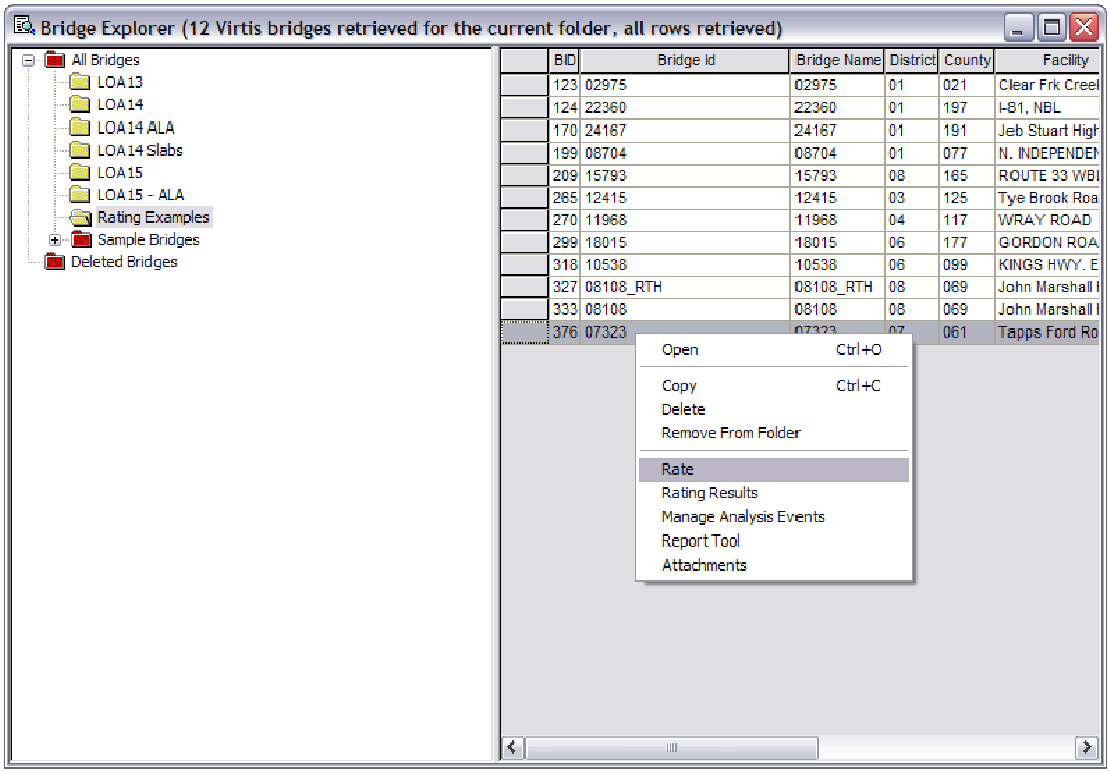
BRASS-GIRDER - Version 6.00.03 - Apr. 14, 2010 *** BRASS Export Version 6.2.0.3001

Close

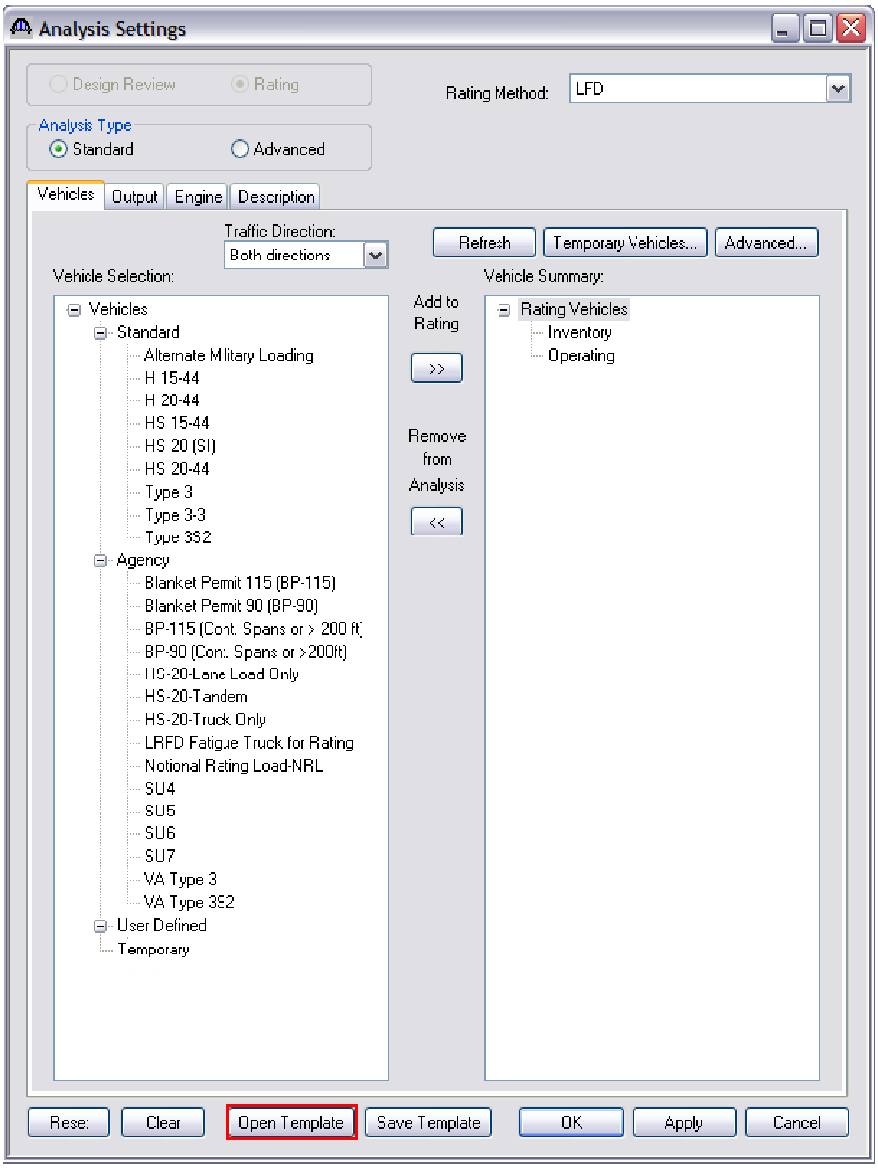
## ANALYZE FILE FROM BRIDGE EXPLORER




To analyze the entire file at once, first **Save** and then **Close** the bridge.



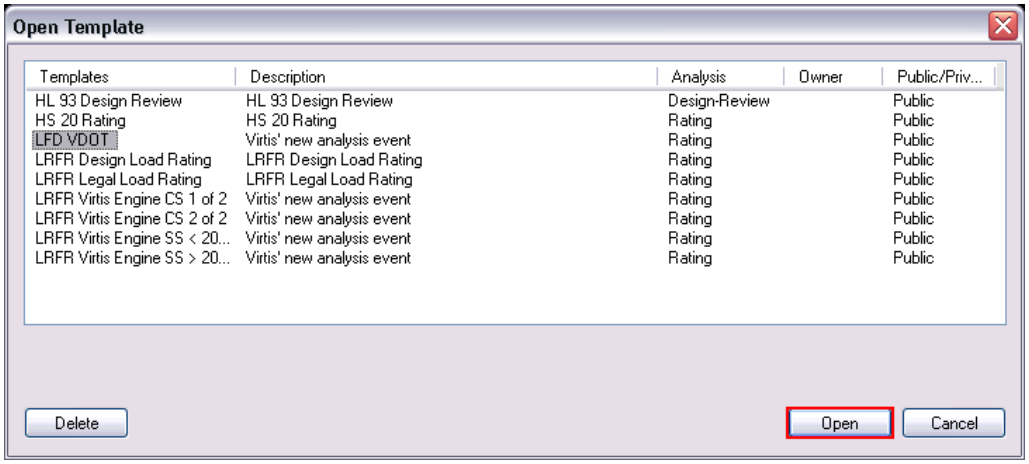

In the **Bridge Explorer** window, select the bridge, right click, and select **Rate**.



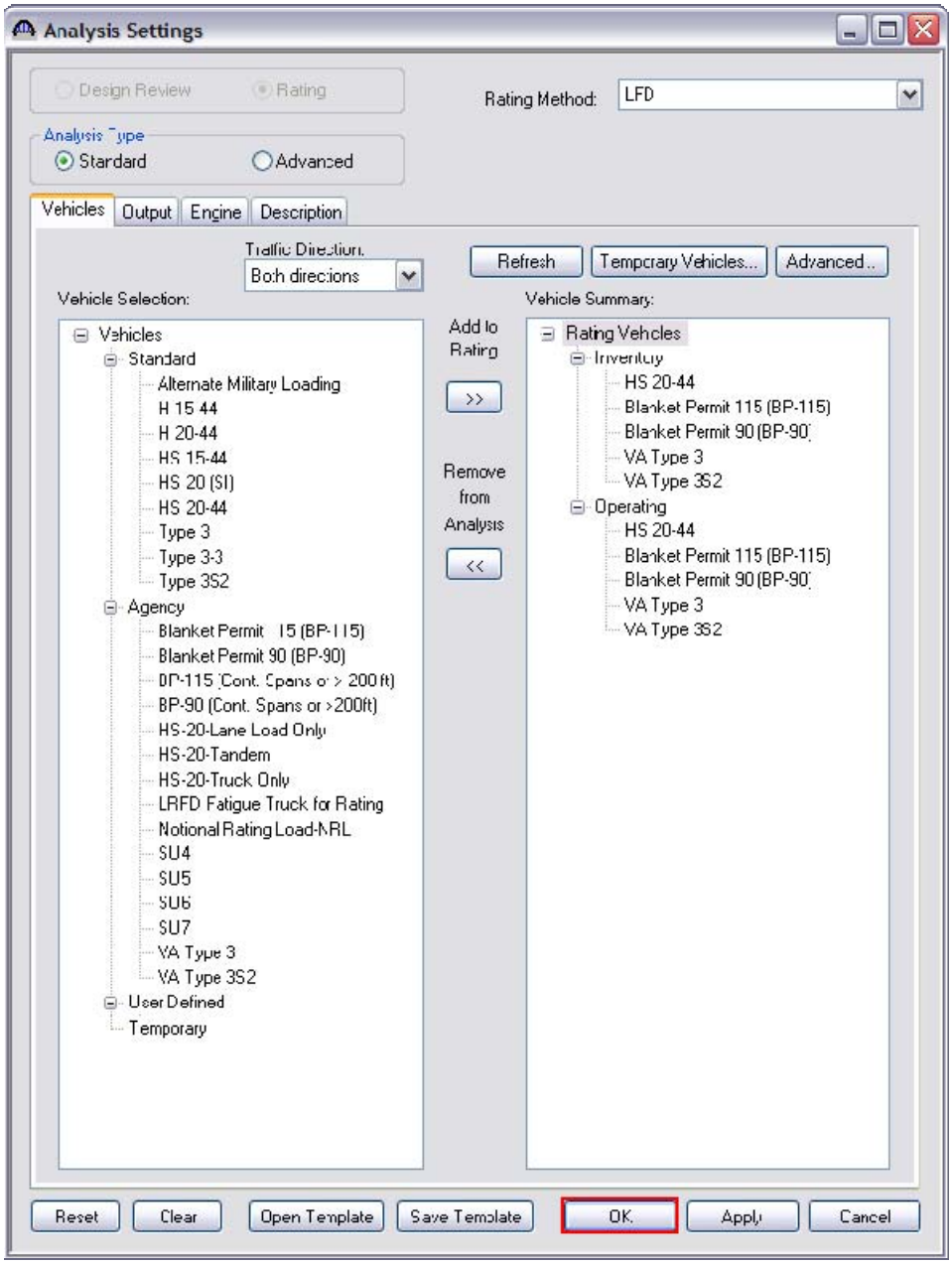

The **Analysis Settings** window will appear.

Left click the O**pen Template** button.

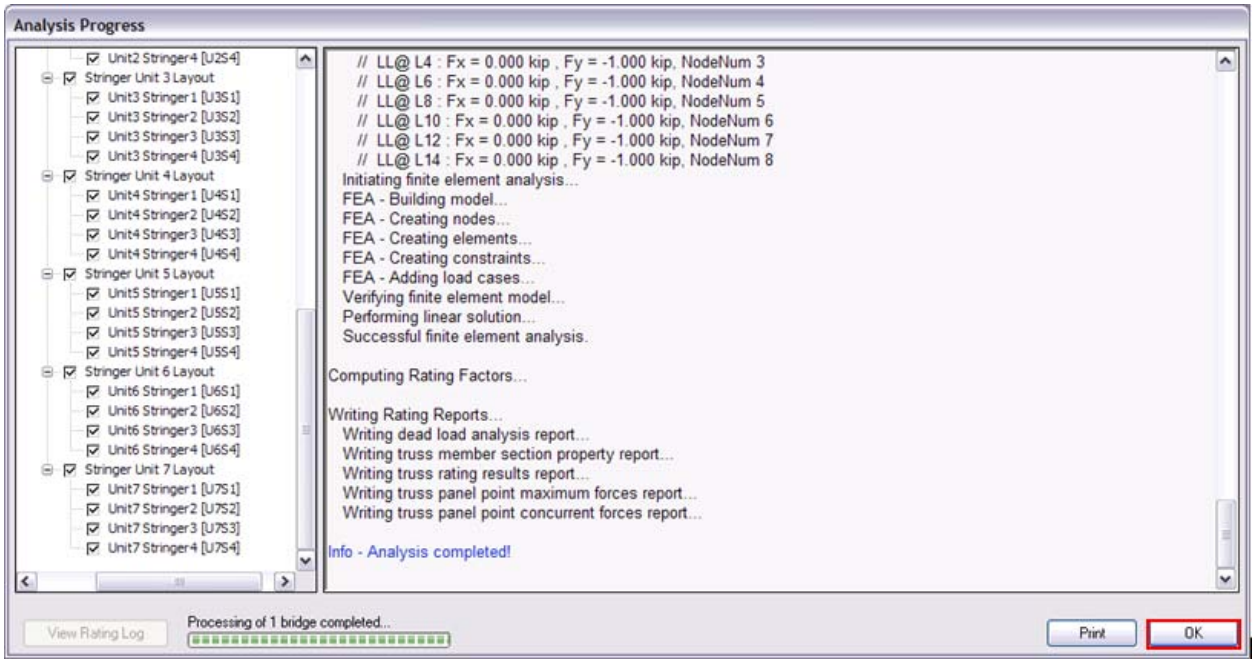
If a template has not already been created, see previous steps on how to create a template in the **Analysis** section of this document.




Left click **LFD VDOT** and left click the **Open** button.

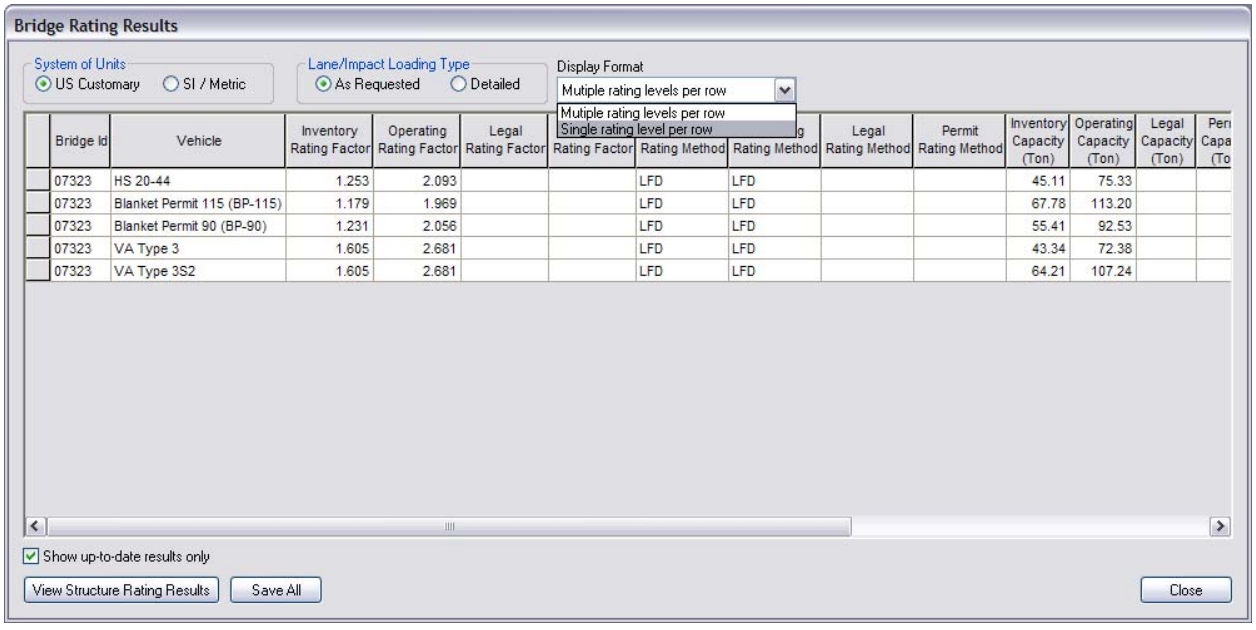



Left click **OK** to accept the template and rate.


Analysis Progress
Unit2 Stringer4 [U2S4]
Stringer Unit 3 Layout
Unit3 Stringer1 [U3S1]
Unit3 Stringer2 [U3S2]
Unit3 Stringer3 [U3S3]
Unit3 Stringer4 [U3S4]
Stringer Unit 4 Layout
Unit4 Stringer1 [U4S1]
Unit4 Stringer2 [U4S2]
Unit4 Stringer3 [U4S3]
Unit4 Stringer4 [U4S4]
Stringer Unit 5 Layout
Unit5 Stringer1 [U5S1]
Unit5 Stringer2 [U5S2]
Unit5 Stringer3 [U5S3]
Unit5 Stringer4 [U5S4]
Stringer Unit 6 Layout
Unit6 Stringer1 [U6S1]
Unit6 Stringer2 [U6S2]
Unit6 Stringer3 [U6S3]
Unit6 Stringer4 [U6S4]
Stringer Unit 7 Layout
Unit7 Stringer1 [U7S1]
Unit7 Stringer2 [U7S2]
Unit7 Stringer3 [U7S3]
Unit7 Stringer4 [U7S4]
// LL@ L4 : Fx = 0.000 kip , Fy = -1.000 kip, NodeNum 3
// LL@ L6 : Fx = 0.000 kip , Fy = -1.000 kip, NodeNum 4
// LL@ L8 : Fx = 0.000 kip , Fy = -1.000 kip, NodeNum 5
// LL@ L10 : Fx = 0.000 kip , Fy = -1.000 kip, NodeNum 6
// LL@ L12 : Fx = 0.000 kip , Fy = -1.000 kip, NodeNum 7
// LL@ L14 : Fx = 0.000 kip , Fy = -1.000 kip, NodeNum 8
Initiating finite element analysis...
FEA - Building model...
FEA - Creating nodes...
FEA - Creating elements...
FEA - Creating constraints...
FEA - Adding load cases...
Verifying finite element model...
Performing linear solution...
Successful finite element analysis.
Computing Rating Factors...
Writing Rating Reports...
Writing dead load analysis report...
Writing truss member section property report...
Writing truss rating results report...
Writing truss panel point maximum forces report...
Writing truss panel point concurrent forces report...
Info - Analysis completed!
View Rating Log
Processing of 1 bridge completed...
Print
OK

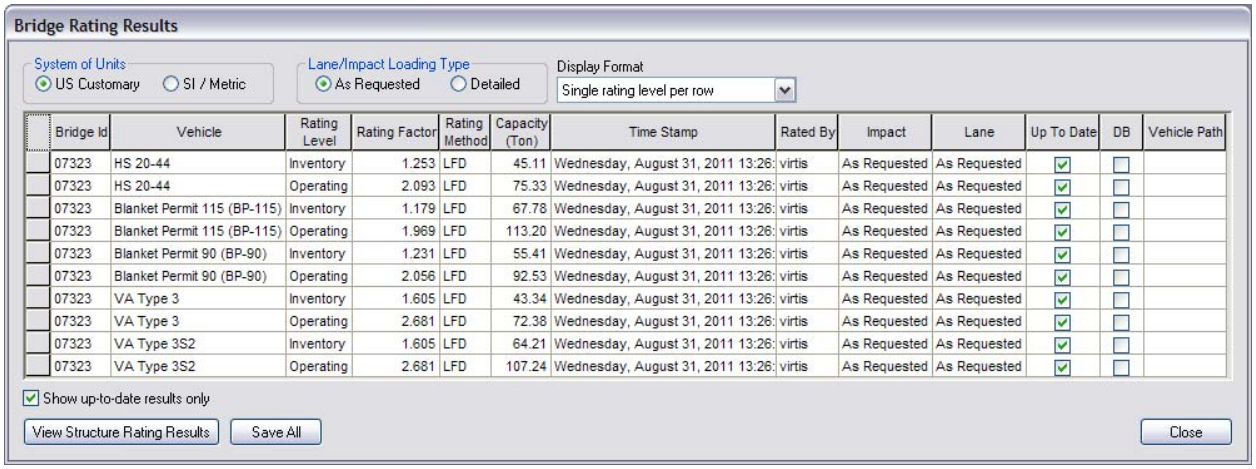
Allow the bridge to run. Once the analysis is completed, the user can read any warnings or errors by scrolling up on the **Analysis Progress** window.

Left click **OK** to view results.




The **Bridge Rating Results** window will appear. To view a more compact set of results, select **Single rating level per row**.

## FINAL STRUCTURE RATINGS



Bridge Rating Results

System of Units: (•) US Customary ( ) SI / Metric

Lane/Impact Loading Type: (•) As Requested ( ) Detailed

Display Format: Single rating level per row

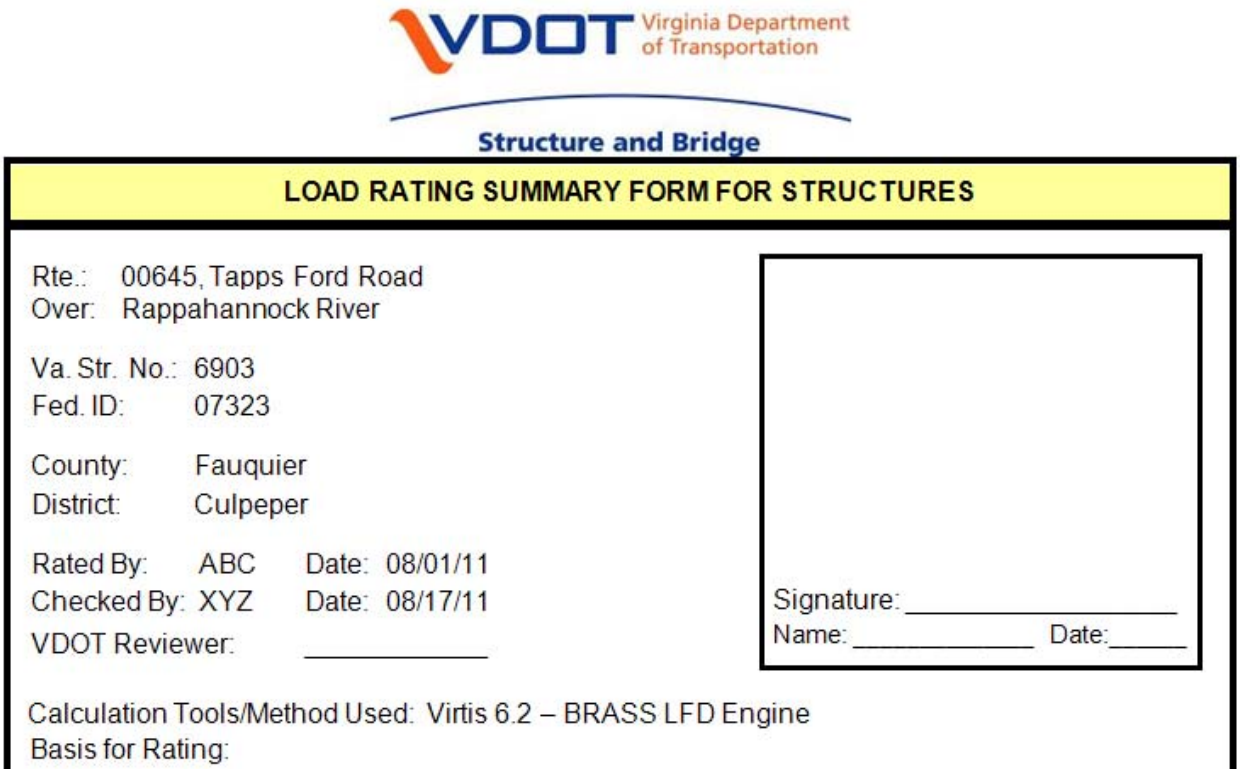
| Bridge Id | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | HS 20-44 | Inventory | 1.253 | LFD | 45.11 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | HS 20-44 | Operating | 2.093 | LFD | 75.33 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Inventory | 1.179 | LFD | 67.78 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Operating | 1.969 | LFD | 113.20 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Inventory | 1.231 | LFD | 55.41 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Operating | 2.056 | LFD | 92.53 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Inventory | 1.605 | LFD | 43.34 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Operating | 2.681 | LFD | 72.38 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Inventory | 1.605 | LFD | 64.21 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Operating | 2.681 | LFD | 107.24 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |

☑ Show up-to-date results only

View Structure Rating Results | Save All | Close

## COMPLETING VDOT LFD RATING FORM

Complete the information fields at the top portion of rating form. Information can be obtained from the current inspection report for the bridge.



VDOT Virginia Department of Transportation

Structure and Bridge

**LOAD RATING SUMMARY FORM FOR STRUCTURES**

Rte.: 00645, Tapps Ford Road
Over: Rappahannock River

Va. Str. No.: 6903
Fed. ID: 07323

County: Fauquier
District: Culpeper

Rated By: ABC Date: 08/01/11
Checked By: XYZ Date: 08/17/11
VDOT Reviewer: _____

Signature: _____
Name: _____ Date: _____

Calculation Tools/Method Used: Virtis 6.2 – BRASS LFD Engine
Basis for Rating:

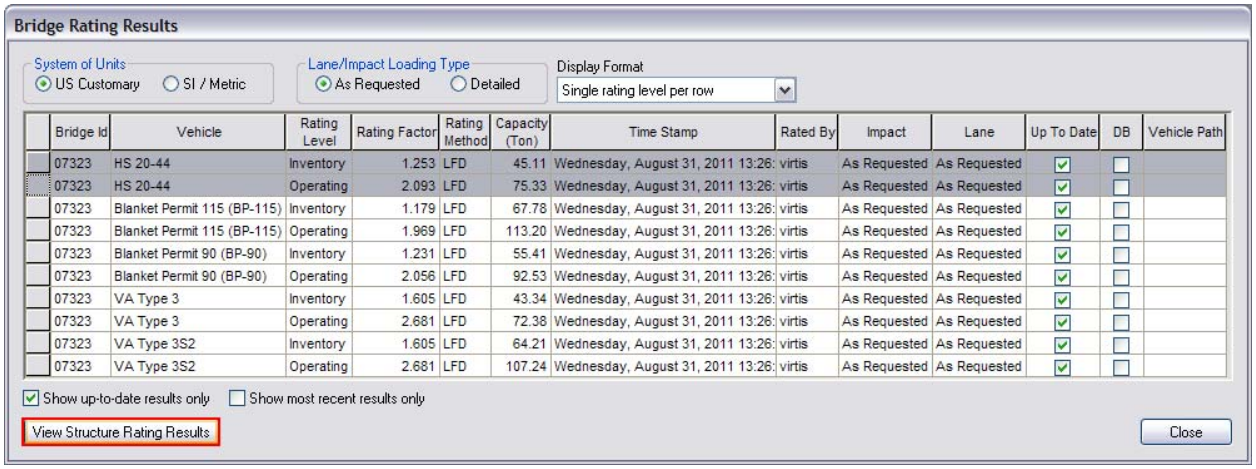
The **VDOT Reviewer** field should be left blank.

The box in the upper right hand corner of the rating form is for the seal and signature of a professional engineer licensed in the state of Virginia.

**DESIGN LOAD: HS-20**

| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| | | TONS | | | |
| HS-20 (INV) | 36 | | | | |
| HS-20 (OPR) | 36 | | | | |

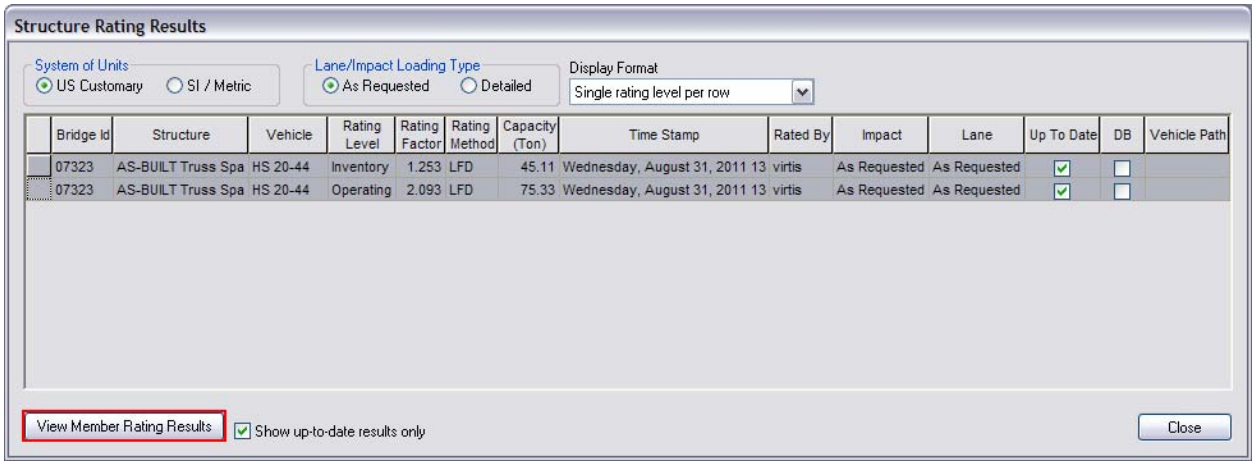
To fill out the rating information for the HS-20 vehicle, first highlight the **HS 20-44** rows in the **Bridge Rating Results** window.




| Bridge Id | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | HS 20-44 | Inventory | 1.253 | LFD | 45.11 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | HS 20-44 | Operating | 2.093 | LFD | 75.33 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Inventory | 1.179 | LFD | 67.78 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Operating | 1.969 | LFD | 113.20 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Inventory | 1.231 | LFD | 55.41 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Operating | 2.056 | LFD | 92.53 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Inventory | 1.605 | LFD | 43.34 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Operating | 2.681 | LFD | 72.38 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Inventory | 1.605 | LFD | 64.21 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Operating | 2.681 | LFD | 107.24 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |

Then, left click the **View Structure Rating Results** window.

The **Structure Rating Results** window will appear. Highlight the two rows.

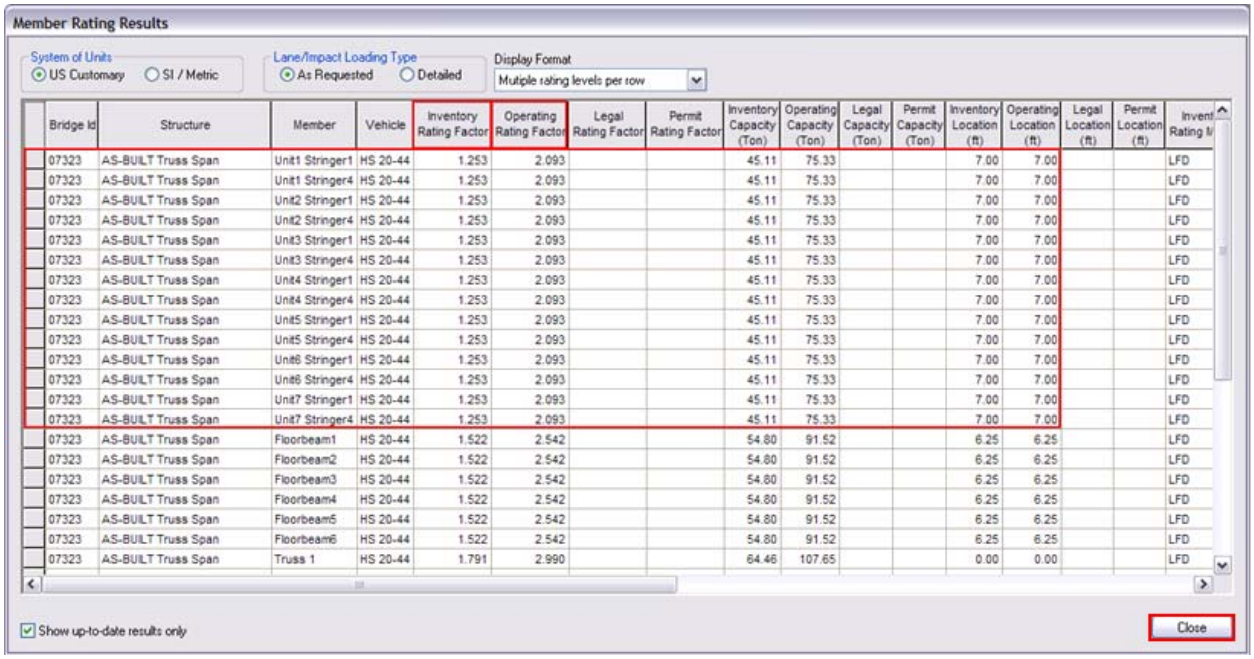



| Bridge Id | Structure | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Spa | HS 20-44 | Inventory | 1.253 | LFD | 45.11 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | AS-BUILT Truss Spa | HS 20-44 | Operating | 2.093 | LFD | 75.33 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested | ☑ | ☐ | |

Left click the **View Member Rating Results** button.

The **Member Rating Results** window will appear. Select **Multiple Rating Levels per Row** from the Display Format drop down menu for easier viewing of the results.

Double click the **Inventory Rating Factor** column to sort the rating factors from smallest to greatest. The same can be done for the **Operating Rating Factor** column. For this example, the same members that control for inventory are controlling for operating.




| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) | Legal Location (ft) | Permit Location (ft) | Invent Rating M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Unit1 Stringer1 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer4 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer1 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer4 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer1 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer4 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer1 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer4 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer1 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer4 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer1 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer4 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer1 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer4 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam1 | HS 20-44 | 1.522 | 2.542 | | | 54.80 | 91.52 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam2 | HS 20-44 | 1.522 | 2.542 | | | 54.80 | 91.52 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam3 | HS 20-44 | 1.522 | 2.542 | | | 54.80 | 91.52 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam4 | HS 20-44 | 1.522 | 2.542 | | | 54.80 | 91.52 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam5 | HS 20-44 | 1.522 | 2.542 | | | 54.80 | 91.52 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam6 | HS 20-44 | 1.522 | 2.542 | | | 54.80 | 91.52 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Truss 1 | HS 20-44 | 1.791 | 2.990 | | | 64.46 | 107.65 | | | 0.00 | 0.00 | | | LFD |

By observation, the exterior stringers control the rating.

| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Unit1 Stringer1 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer4 | HS 20-44 | 1.253 | 2.093 | | | 45.11 | 75.33 | | | 7.00 | 7.00 |

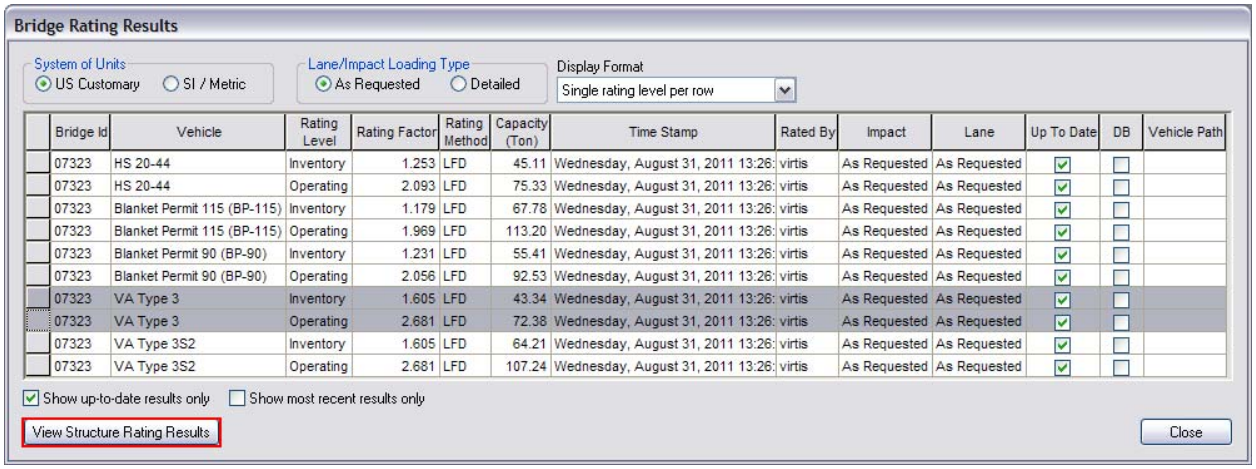
| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| | | TONS | | | |
| HS-20 (INV) | 36 | 45 | Ext. Stringers | 7.00 | |
| HS-20 (OPR) | 36 | 75 | Ext. Stringers | 7.00 | |

Left Click the **Close** button for the **Member Rating Results** and the **Structure Rating Results** windows.

## LEGAL LOAD: VA TYPE 3

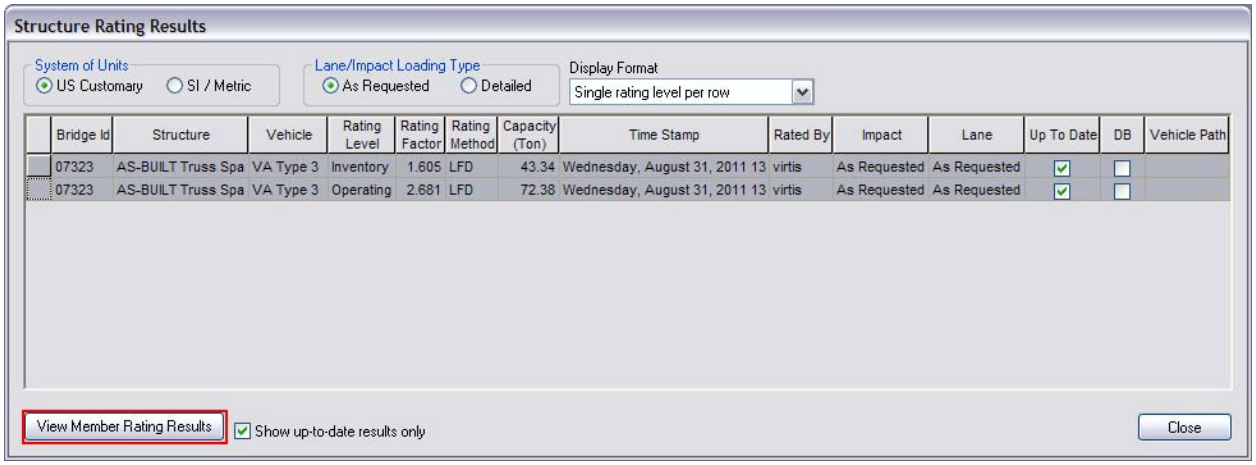
| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| **LEGAL LOADS** | | TONS | ** | | |
| VA Type 3 | 27 | | | | |
| VA Type 3S2 | 40 | | | | |
| *, ***LANE | 40 | --- | --- | --- | --- |

To fill out the rating information for the VA Type 3 vehicle, first highlight the **VA Type 3** rows in the **Bridge Rating Results** window.


Bridge Rating Results
System of Units
US Customary
SI / Metric
Lane/Impact Loading Type
As Requested
Detailed
Display Format
Single rating level per row
Bridge Id | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path
07323 | HS 20-44 | Inventory | 1.253 | LFD | 45.11 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
07323 | HS 20-44 | Operating | 2.093 | LFD | 75.33 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
07323 | Blanket Permit 115 (BP-115) | Inventory | 1.179 | LFD | 67.78 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
07323 | Blanket Permit 115 (BP-115) | Operating | 1.969 | LFD | 113.20 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
07323 | Blanket Permit 90 (BP-90) | Inventory | 1.231 | LFD | 55.41 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
07323 | Blanket Permit 90 (BP-90) | Operating | 2.056 | LFD | 92.53 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
07323 | VA Type 3 | Inventory | 1.605 | LFD | 43.34 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
07323 | VA Type 3 | Operating | 2.681 | LFD | 72.38 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
07323 | VA Type 3S2 | Inventory | 1.605 | LFD | 64.21 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
07323 | VA Type 3S2 | Operating | 2.681 | LFD | 107.24 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested
Show up-to-date results only
Show most recent results only
View Structure Rating Results
Close

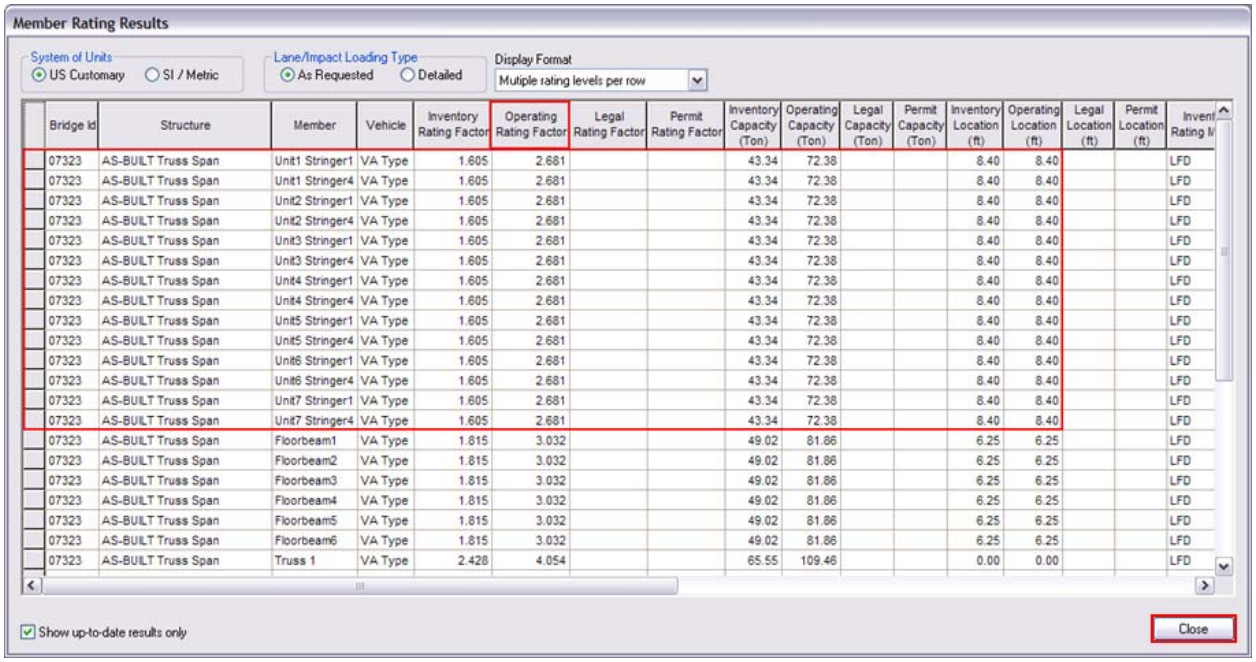
Then, left click the **View Structure Rating Results** window.

The **Structure Rating Results** window will appear. Highlight the two rows.


Structure Rating Results
System of Units
US Customary
SI / Metric
Lane/Impact Loading Type
As Requested
Detailed
Display Format
Single rating level per row
Bridge Id | Structure | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path
07323 | AS-BUILT Truss Spa | VA Type 3 | Inventory | 1.605 | LFD | 43.34 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested
07323 | AS-BUILT Truss Spa | VA Type 3 | Operating | 2.681 | LFD | 72.38 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested
View Member Rating Results
Show up-to-date results only
Close

Left click the **View Member Rating Results** button.

The **Member Rating Results** window will appear. Select **Multiple Rating Levels per Row** from the Display Format drop down menu. Double click the **Operating Rating Factor** column to sort the rating factors from smallest to greatest.




| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) | Legal Location (ft) | Permit Location (ft) | Invent Rating M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Unit1 Stringer1 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer4 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer1 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer4 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer1 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer4 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer1 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer4 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer1 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer4 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer1 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer4 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer1 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer4 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam1 | VA Type | 1.815 | 3.032 | | | 49.02 | 81.86 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam2 | VA Type | 1.815 | 3.032 | | | 49.02 | 81.86 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam3 | VA Type | 1.815 | 3.032 | | | 49.02 | 81.86 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam4 | VA Type | 1.815 | 3.032 | | | 49.02 | 81.86 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam5 | VA Type | 1.815 | 3.032 | | | 49.02 | 81.86 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam6 | VA Type | 1.815 | 3.032 | | | 49.02 | 81.86 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Truss 1 | VA Type | 2.428 | 4.054 | | | 65.55 | 109.46 | | | 0.00 | 0.00 | | | LFD |

By observation, the exterior stringers control the rating.

| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Unit1 Stringer1 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer4 | VA Type | 1.605 | 2.681 | | | 43.34 | 72.38 | | | 8.40 | 8.40 |

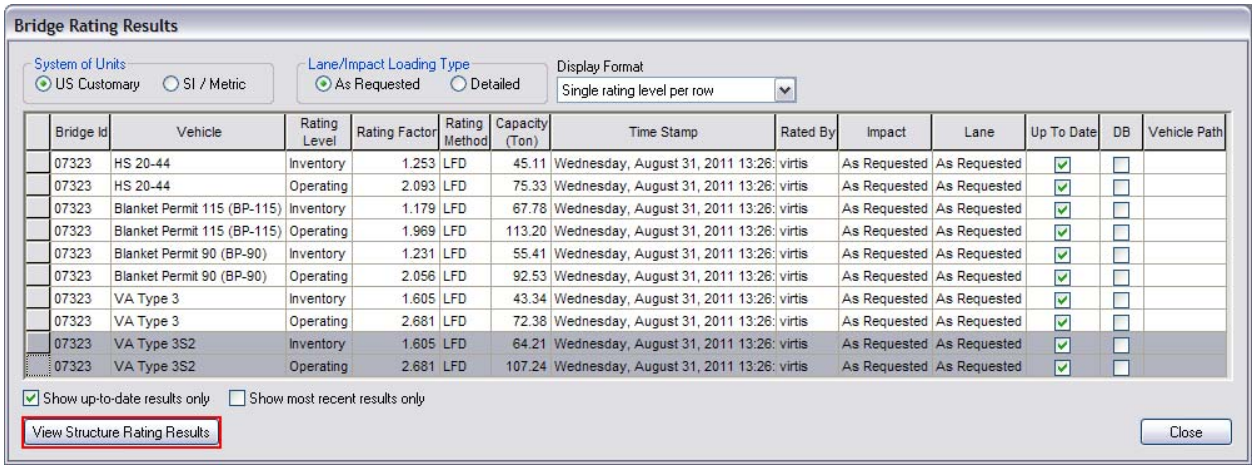
| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| **LEGAL LOADS** | | TONS | ** | | |
| VA Type 3 | 27 | 72 | Ext. Stringers | 8.40 | |
| VA Type 3S2 | 40 | | | | |
| *, ***LANE | 40 | --- | --- | --- | --- |

Left Click the **Close** button for the **Member Rating Results** and the **Structure Rating Results** windows.

## LEGAL LOAD: VA TYPE 3S2

| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| **LEGAL LOADS** | | TONS | ** | | |
| VA Type 3 | 27 | 72 | Ext. Stringers | 8.40 | |
| VA Type 3S2 | 40 | | | | |
| *, ***LANE | 40 | --- | --- | --- | --- |

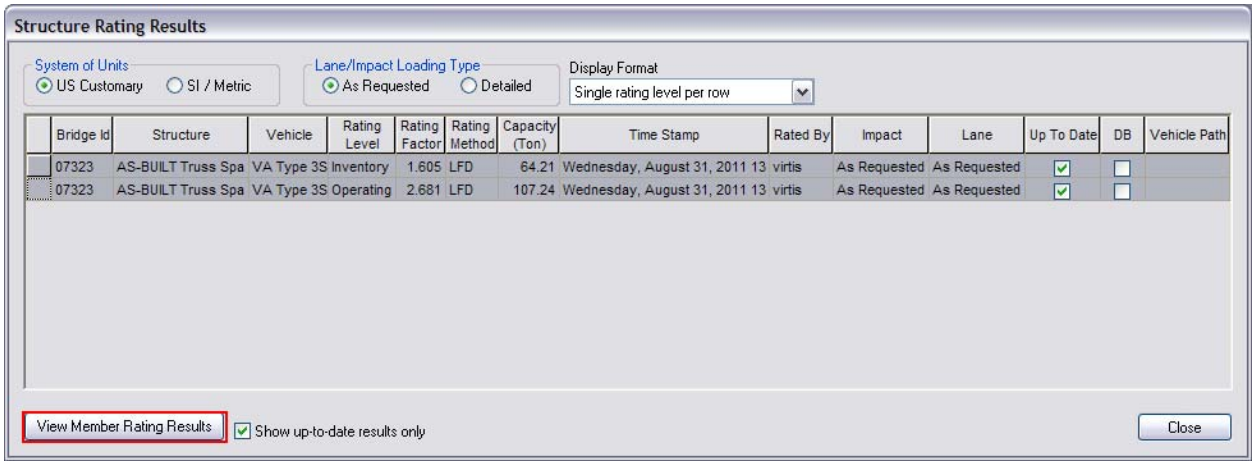
To fill out the rating information for the VA Type 3S2 vehicle, first highlight the **VA Type 3S2** rows in the **Bridge Rating Results** window.




| Bridge Id | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | HS 20-44 | Inventory | 1.253 | LFD | 45.11 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | HS 20-44 | Operating | 2.093 | LFD | 75.33 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Inventory | 1.179 | LFD | 67.78 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Operating | 1.969 | LFD | 113.20 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Inventory | 1.231 | LFD | 55.41 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Operating | 2.056 | LFD | 92.53 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Inventory | 1.605 | LFD | 43.34 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Operating | 2.681 | LFD | 72.38 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Inventory | 1.605 | LFD | 64.21 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Operating | 2.681 | LFD | 107.24 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |

Then, left click the **View Structure Rating Results** window.

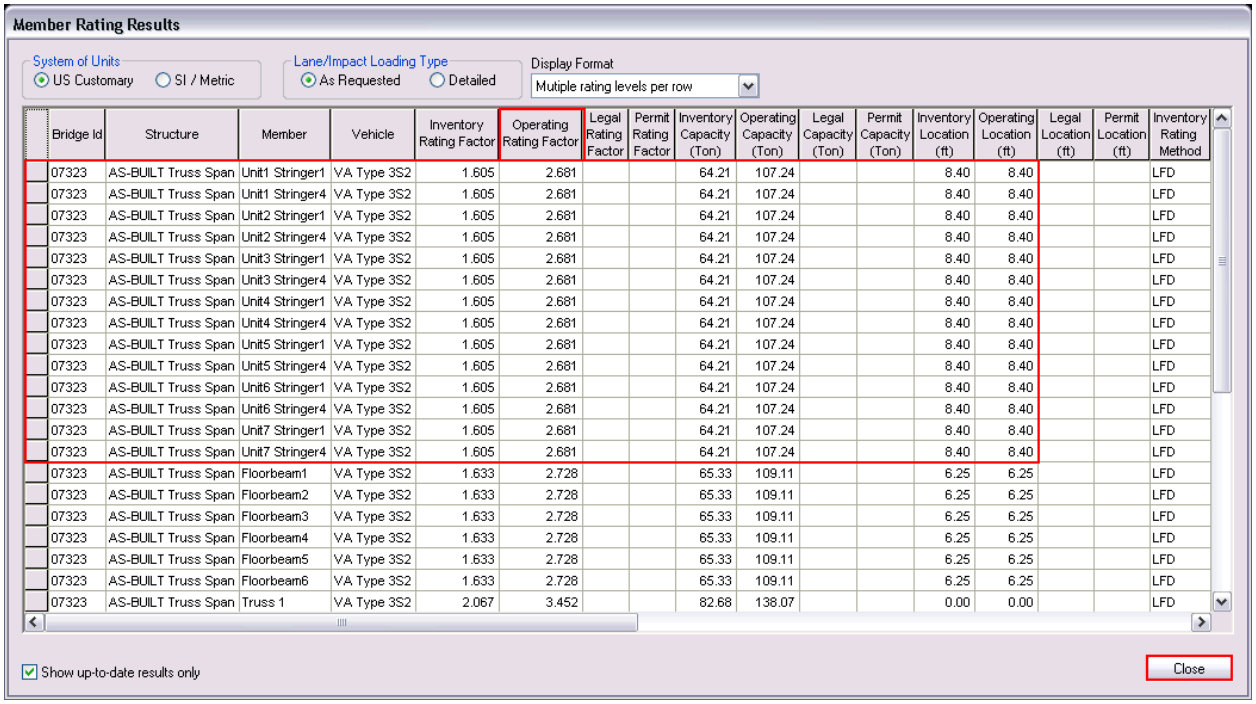
The **Structure Rating Results** window will appear. Highlight the two rows.




| Bridge Id | Structure | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Spa | VA Type 3S | Inventory | 1.605 | LFD | 64.21 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | AS-BUILT Truss Spa | VA Type 3S | Operating | 2.681 | LFD | 107.24 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested | ☑ | ☐ | |

Left click the **View Member Rating Results** button.

The **Member Rating Results** window will appear. Select **Multiple Rating Levels per Row** from the Display Format drop down menu. Double click the **Operating Rating Factor** column to sort the rating factors from smallest to greatest.



Member Rating Results

System of Units: US Customary / SI / Metric — Lane/Impact Loading Type: As Requested / Detailed — Display Format: Mutiple rating levels per row

| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) | Legal Location (ft) | Permit Location (ft) | Inventory Rating Method |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Unit1 Stringer1 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer4 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer1 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer4 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer1 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer4 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer1 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer4 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer1 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer4 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer1 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer4 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer1 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer4 | VA Type 3S2 | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam1 | VA Type 3S2 | 1.633 | 2.728 | | | 65.33 | 109.11 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam2 | VA Type 3S2 | 1.633 | 2.728 | | | 65.33 | 109.11 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam3 | VA Type 3S2 | 1.633 | 2.728 | | | 65.33 | 109.11 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam4 | VA Type 3S2 | 1.633 | 2.728 | | | 65.33 | 109.11 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam5 | VA Type 3S2 | 1.633 | 2.728 | | | 65.33 | 109.11 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam6 | VA Type 3S2 | 1.633 | 2.728 | | | 65.33 | 109.11 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Truss 1 | VA Type 3S2 | 2.067 | 3.452 | | | 82.68 | 138.07 | | | 0.00 | 0.00 | | | LFD |

Show up-to-date results only — Close

By observation, the exterior stringers control the rating.

| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Unit1 Stringer1 | VA Type | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer4 | VA Type | 1.605 | 2.681 | | | 64.21 | 107.24 | | | 8.40 | 8.40 |

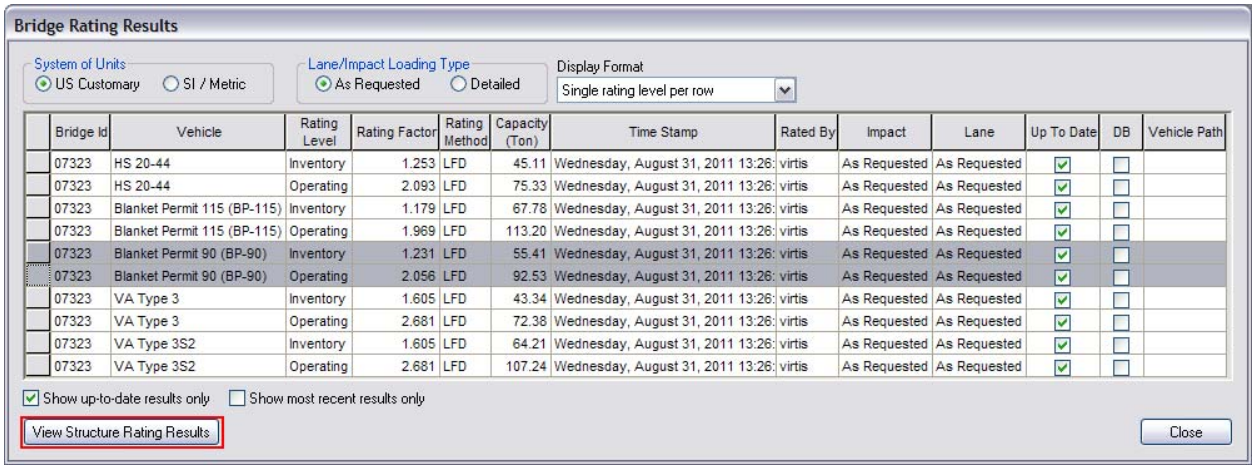
| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| **LEGAL LOADS** | | TONS | ** | | |
| VA Type 3 | 27 | 72 | Ext. Stringers | 8.40 | |
| VA Type 3S2 | 40 | 107 | Ext. Stringers | 8.40 | |
| *, ***LANE | 40 | --- | --- | --- | --- |

Left Click the **Close** button for the **Member Rating Results** and the **Structure Rating Results** windows.

**PERMIT LOAD: BP-90**

| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| **PERMIT LOAD** | | TONS | | | |
| BP-90 | 45 | | | | |
| BP-115 | 57.5 | | | | |

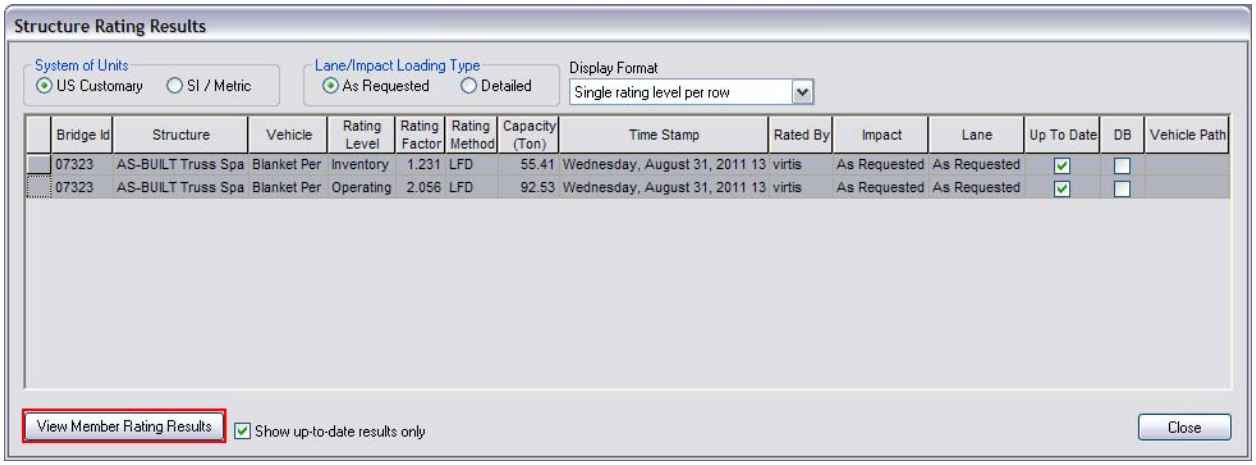
To fill out the rating information for the BP-90 vehicle, first highlight the **Blanket Permit 90** rows in the **Bridge Rating Results** window.




| Bridge Id | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | HS 20-44 | Inventory | 1.253 | LFD | 45.11 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | HS 20-44 | Operating | 2.093 | LFD | 75.33 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Inventory | 1.179 | LFD | 67.78 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Operating | 1.969 | LFD | 113.20 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Inventory | 1.231 | LFD | 55.41 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Operating | 2.056 | LFD | 92.53 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Inventory | 1.605 | LFD | 43.34 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Operating | 2.681 | LFD | 72.38 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Inventory | 1.605 | LFD | 64.21 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Operating | 2.681 | LFD | 107.24 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |

Then, left click the **View Structure Rating Results** window.

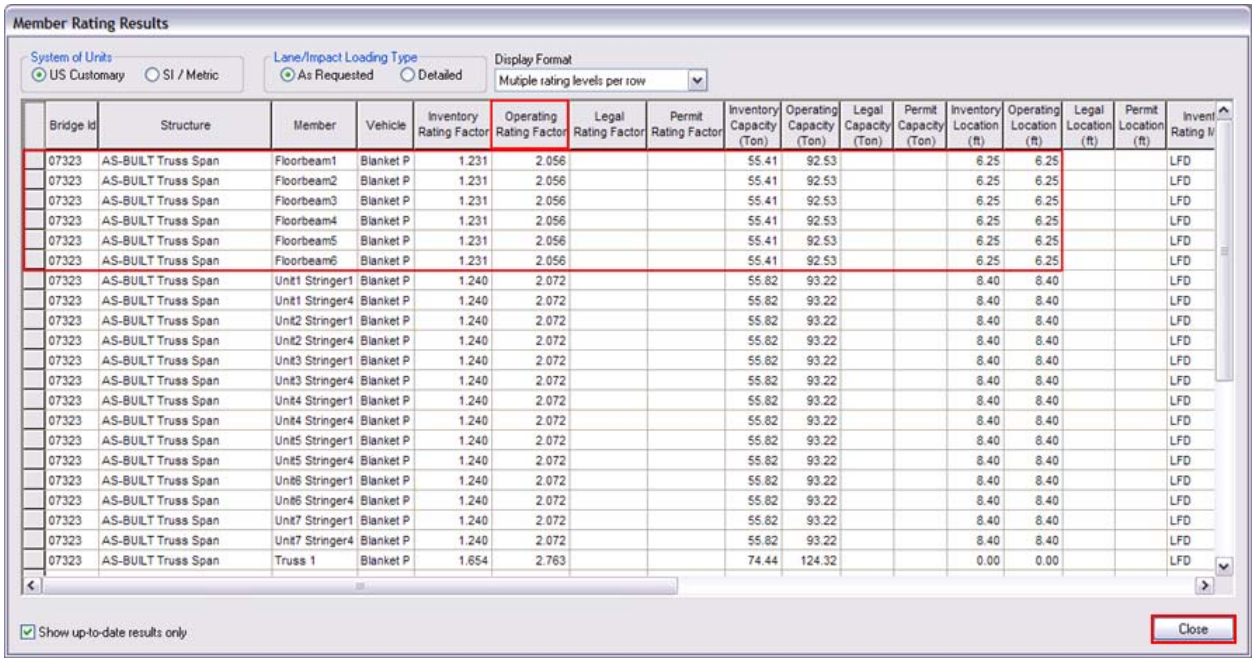
The **Structure Rating Results** window will appear. Highlight the two rows.




| Bridge Id | Structure | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Spa | Blanket Per | Inventory | 1.231 | LFD | 55.41 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | AS-BUILT Truss Spa | Blanket Per | Operating | 2.056 | LFD | 92.53 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested | ☑ | ☐ | |

Left click the **View Member Rating Results** button.

The **Member Rating Results** window will appear. Select **Multiple Rating Levels per Row** from the Display Format drop down menu. Double click the **Operating Rating Factor** column to sort the rating factors from smallest to greatest.




| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) | Legal Location (ft) | Permit Location (ft) | Invent Rating M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Floorbeam1 | Blanket P | 1.231 | 2.056 | | | 55.41 | 92.53 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam2 | Blanket P | 1.231 | 2.056 | | | 55.41 | 92.53 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam3 | Blanket P | 1.231 | 2.056 | | | 55.41 | 92.53 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam4 | Blanket P | 1.231 | 2.056 | | | 55.41 | 92.53 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam5 | Blanket P | 1.231 | 2.056 | | | 55.41 | 92.53 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam6 | Blanket P | 1.231 | 2.056 | | | 55.41 | 92.53 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer1 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer4 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer1 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer4 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer1 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer4 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer1 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer4 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer1 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer4 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer1 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer4 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer1 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer4 | Blanket P | 1.240 | 2.072 | | | 55.82 | 93.22 | | | 8.40 | 8.40 | | | LFD |
| 07323 | AS-BUILT Truss Span | Truss 1 | Blanket P | 1.654 | 2.763 | | | 74.44 | 124.32 | | | 0.00 | 0.00 | | | LFD |

By observation, the floorbeams control the rating.

| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Floorbeam1 | Blanket P | 1.231 | 2.056 | | | 55.41 | 92.53 | | | 6.25 | 6.25 |
| 07323 | AS-BUILT Truss Span | Floorbeam2 | Blanket P | 1.231 | 2.056 | | | 55.41 | 92.53 | | | 6.25 | 6.25 |

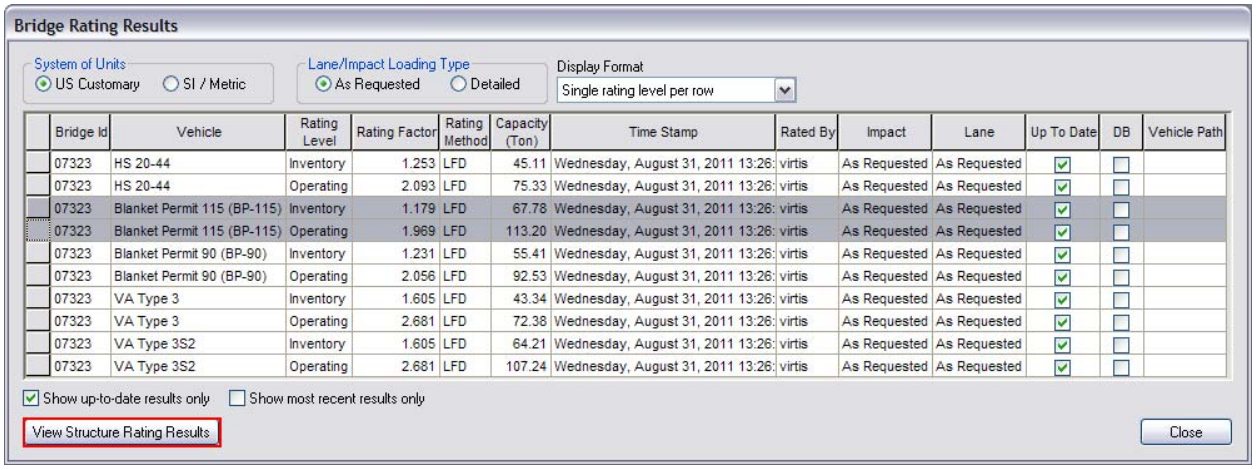
| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| **PERMIT LOAD** | | TONS | | | |
| BP-90 | 45 | 92 | Floorbeams | 6.25 | |
| BP-115 | 57.5 | | | | |

Left Click the **Close** button for the **Member Rating Results** and the **Structure Rating Results** windows.

**PERMIT LOAD: BP-115**

| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| **PERMIT LOAD** | | TONS | | | |
| BP-90 | 45 | 92 | Floorbeams | 6.25 | |
| BP-115 | 57.5 | | | | |

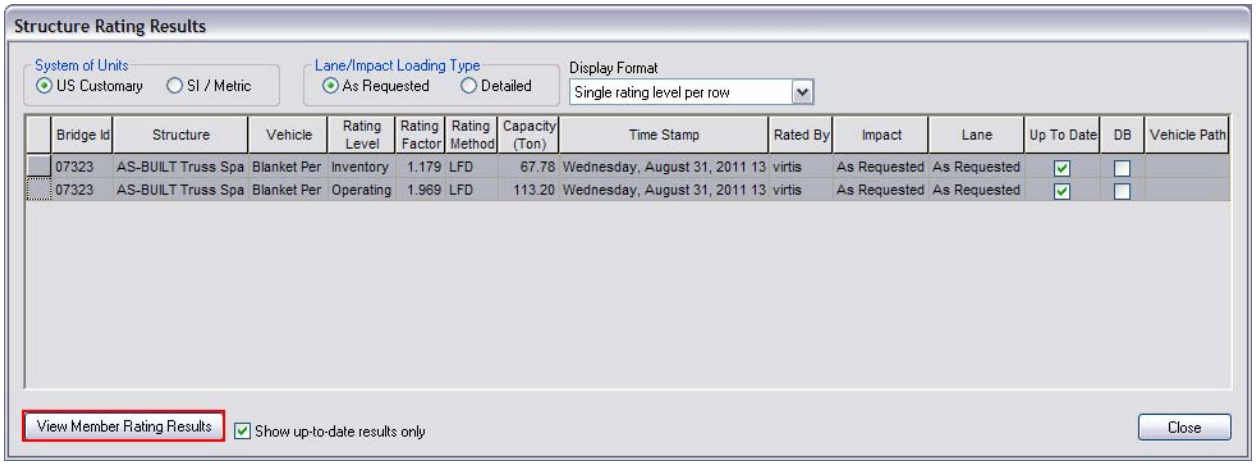
To fill out the rating information for the BP-115 vehicle, first highlight the **Blanket Permit 115** rows in the **Bridge Rating Results** window.




| Bridge Id | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | HS 20-44 | Inventory | 1.253 | LFD | 45.11 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | HS 20-44 | Operating | 2.093 | LFD | 75.33 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Inventory | 1.179 | LFD | 67.78 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 115 (BP-115) | Operating | 1.969 | LFD | 113.20 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Inventory | 1.231 | LFD | 55.41 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | Blanket Permit 90 (BP-90) | Operating | 2.056 | LFD | 92.53 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Inventory | 1.605 | LFD | 43.34 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3 | Operating | 2.681 | LFD | 72.38 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Inventory | 1.605 | LFD | 64.21 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | VA Type 3S2 | Operating | 2.681 | LFD | 107.24 | Wednesday, August 31, 2011 13:26: | virtis | As Requested | As Requested | ☑ | ☐ | |

Then, left click the **View Structure Rating Results** window.

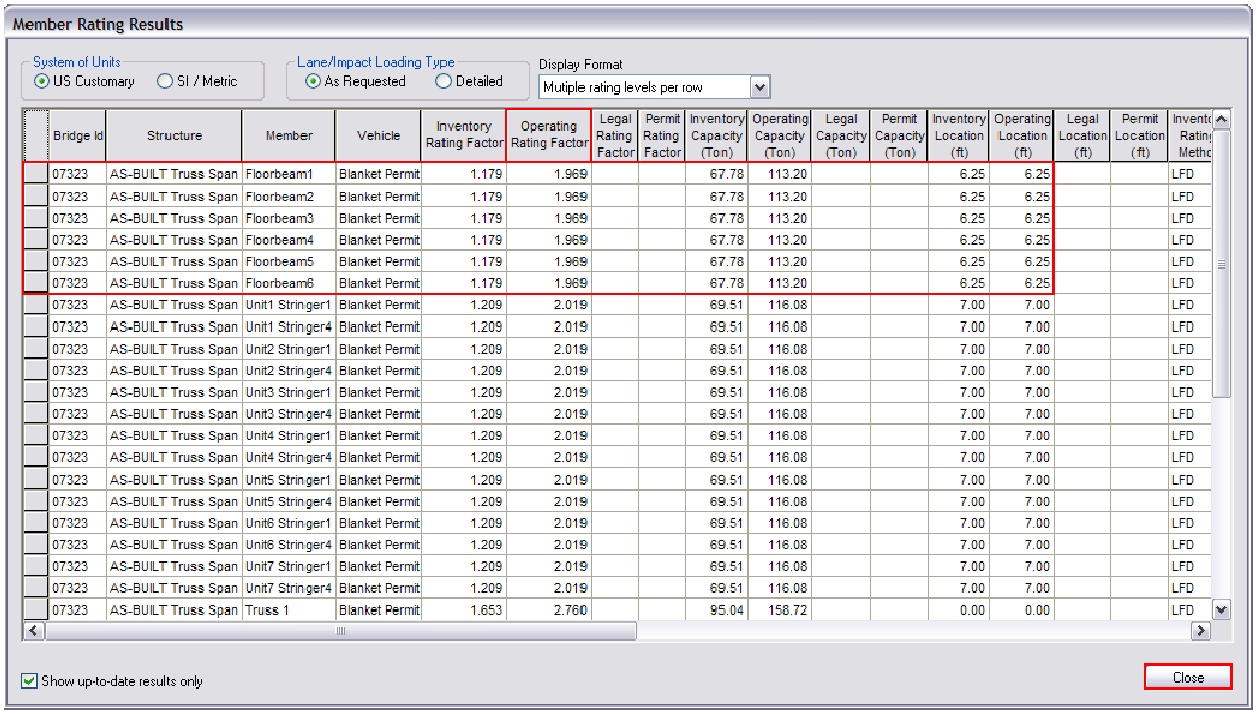
The **Structure Rating Results** window will appear. Highlight the two rows.




| Bridge Id | Structure | Vehicle | Rating Level | Rating Factor | Rating Method | Capacity (Ton) | Time Stamp | Rated By | Impact | Lane | Up To Date | DB | Vehicle Path |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Spa | Blanket Per | Inventory | 1.179 | LFD | 67.78 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested | ☑ | ☐ | |
| 07323 | AS-BUILT Truss Spa | Blanket Per | Operating | 1.969 | LFD | 113.20 | Wednesday, August 31, 2011 13 | virtis | As Requested | As Requested | ☑ | ☐ | |

Left click the **View Member Rating Results** button.

The **Member Rating Results** window will appear. Select **Multiple Rating Levels per Row** from the Display Format drop down menu. Double click the **Operating Rating Factor** column to sort the rating factors from smallest to greatest.




| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) | Legal Location (ft) | Permit Location (ft) | Inventc Ratin Metho |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Floorbeam1 | Blanket Permit | 1.179 | 1.969 | | | 67.78 | 113.20 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam2 | Blanket Permit | 1.179 | 1.969 | | | 67.78 | 113.20 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam3 | Blanket Permit | 1.179 | 1.969 | | | 67.78 | 113.20 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam4 | Blanket Permit | 1.179 | 1.969 | | | 67.78 | 113.20 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam5 | Blanket Permit | 1.179 | 1.969 | | | 67.78 | 113.20 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Floorbeam6 | Blanket Permit | 1.179 | 1.969 | | | 67.78 | 113.20 | | | 6.25 | 6.25 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer1 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit1 Stringer4 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer1 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit2 Stringer4 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer1 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit3 Stringer4 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer1 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit4 Stringer4 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer1 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit5 Stringer4 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer1 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit6 Stringer4 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer1 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Unit7 Stringer4 | Blanket Permit | 1.209 | 2.019 | | | 69.51 | 116.08 | | | 7.00 | 7.00 | | | LFD |
| 07323 | AS-BUILT Truss Span | Truss 1 | Blanket Permit | 1.653 | 2.760 | | | 95.04 | 158.72 | | | 0.00 | 0.00 | | | LFD |

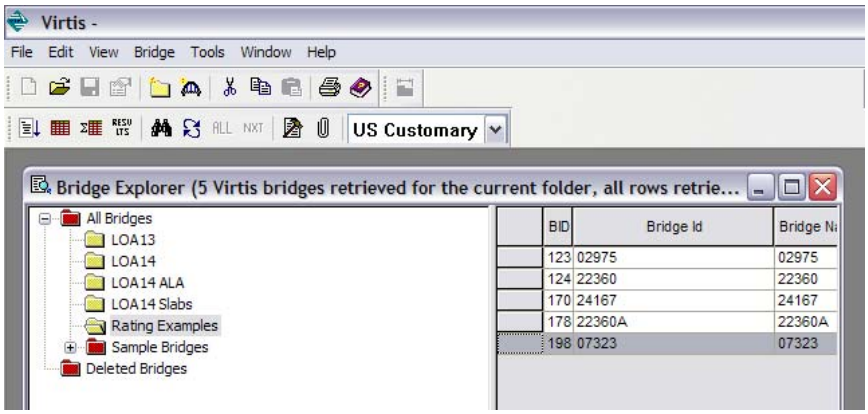
By observation, the floorbeams control the rating.

| Bridge Id | Structure | Member | Vehicle | Inventory Rating Factor | Operating Rating Factor | Legal Rating Factor | Permit Rating Factor | Inventory Capacity (Ton) | Operating Capacity (Ton) | Legal Capacity (Ton) | Permit Capacity (Ton) | Inventory Location (ft) | Operating Location (ft) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 07323 | AS-BUILT Truss Span | Floorbeam1 | Blanket P | 1.179 | 1.969 | | | 67.78 | 113.20 | | | 6.25 | 6.25 |
| 07323 | AS-BUILT Truss Span | Floorbeam2 | Blanket P | 1.179 | 1.969 | | | 67.78 | 113.20 | | | 6.25 | 6.25 |

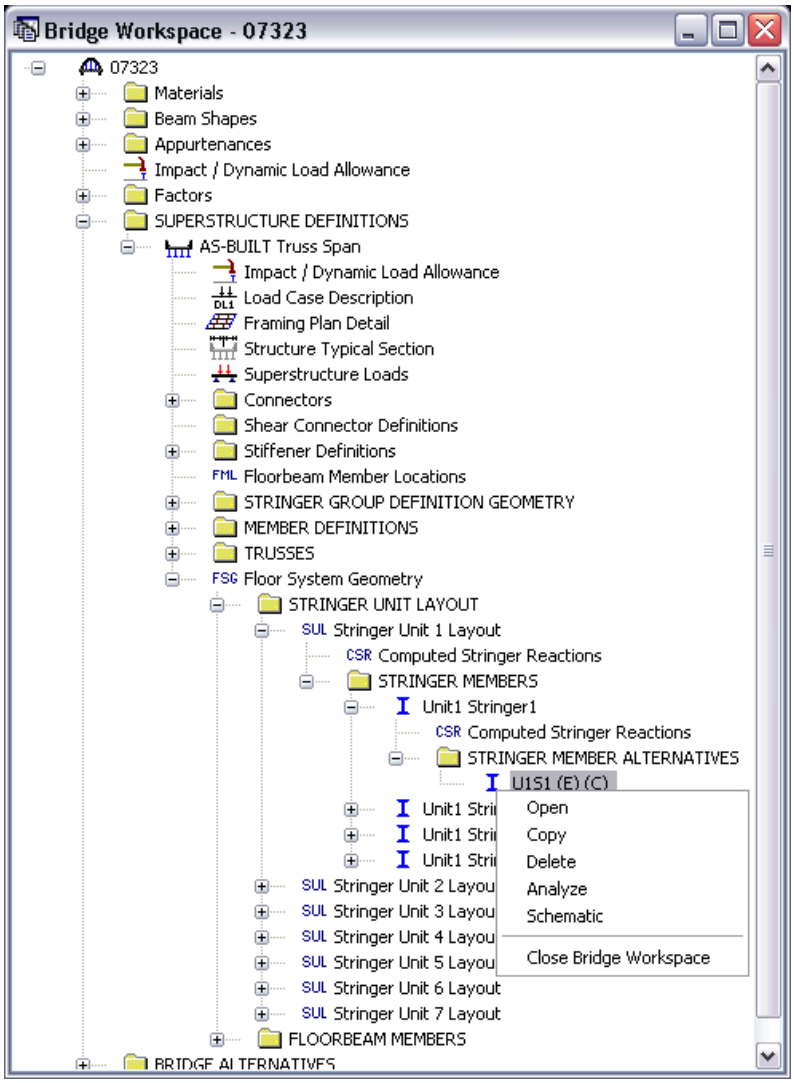
| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| **PERMIT LOAD** | | TONS | | | |
| BP-90 | 45 | 92 | Floorbeams | 6.25 | |
| BP-115 | 57.5 | 113 | Floorbeams | 6.25 | |

Left Click the **Close** button for the **Member Rating Results** and the **Structure Rating Results** windows.

## COMPLETING THE VDOT RATING FORM: CONTROLLING FORCE



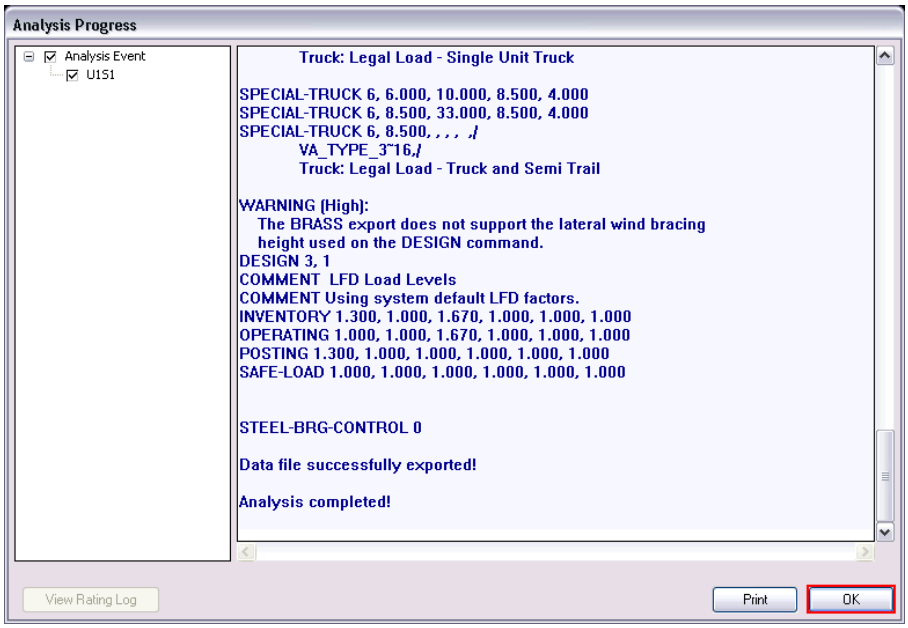

Once the controlling member(s) is known, the user can obtain the controlling force for each vehicle by double clicking the bridge in the Bridge Explorer window to open the file.



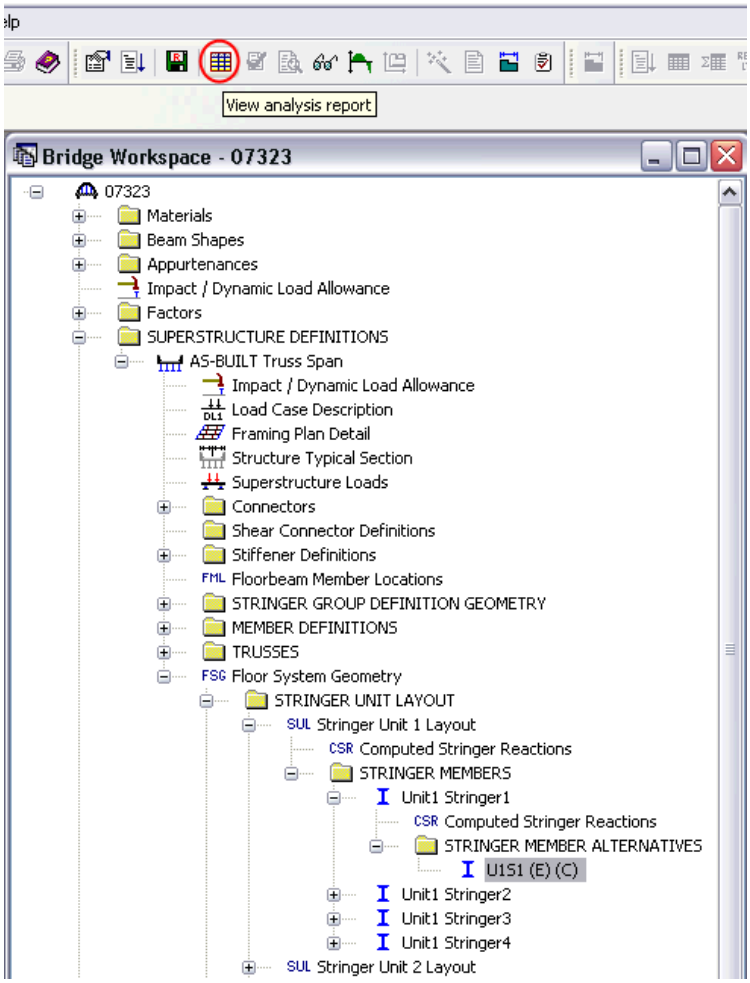

Expand the folders to get to the controlling **MEMBER ALTERNATIVE**. For this example, the **exterior stringers** and the **floorbeams** control the ratings.

Where the exterior stringers control the rating for the HS20, VA Type 3 & VA Type 3S2 vehicles, do the following to determine the controlling member:

Right click one of the **STRINGER MEMBER ALTERNATIVES** for an exterior stringer and select **Analyze**.


Analysis Progress
Analysis Event
U1S1
Truck: Legal Load - Single Unit Truck
SPECIAL-TRUCK 6, 6.000, 10.000, 8.500, 4.000
SPECIAL-TRUCK 6, 8.500, 33.000, 8.500, 4.000
SPECIAL-TRUCK 6, 8.500, , , , ,/
VA_TYPE_3"16,/
Truck: Legal Load - Truck and Semi Trail
WARNING (High):
The BRASS export does not support the lateral wind bracing
height used on the DESIGN command.
DESIGN 3, 1
COMMENT LFD Load Levels
COMMENT Using system default LFD factors.
INVENTORY 1.300, 1.000, 1.670, 1.000, 1.000, 1.000
OPERATING 1.000, 1.000, 1.670, 1.000, 1.000, 1.000
POSTING 1.300, 1.000, 1.000, 1.000, 1.000, 1.000
SAFE-LOAD 1.000, 1.000, 1.000, 1.000, 1.000, 1.000
STEEL-BRG-CONTROL 0
Data file successfully exported!
Analysis completed!
View Rating Log
Print
OK

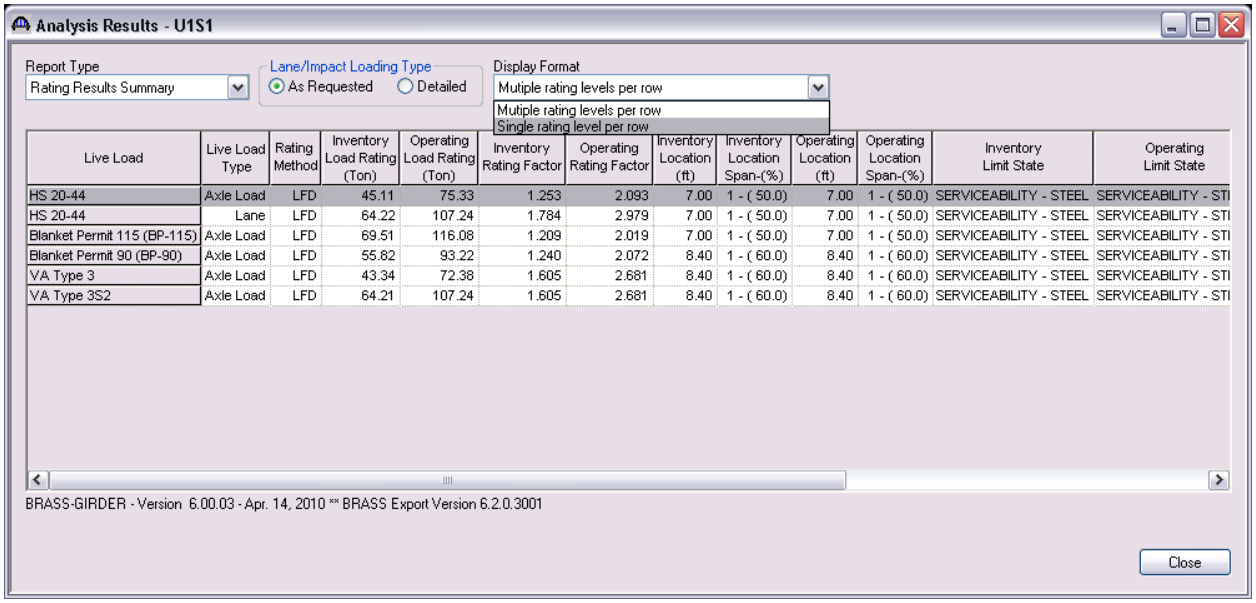
Left click **OK** on the **Analysis Progress** window when the analysis is complete.

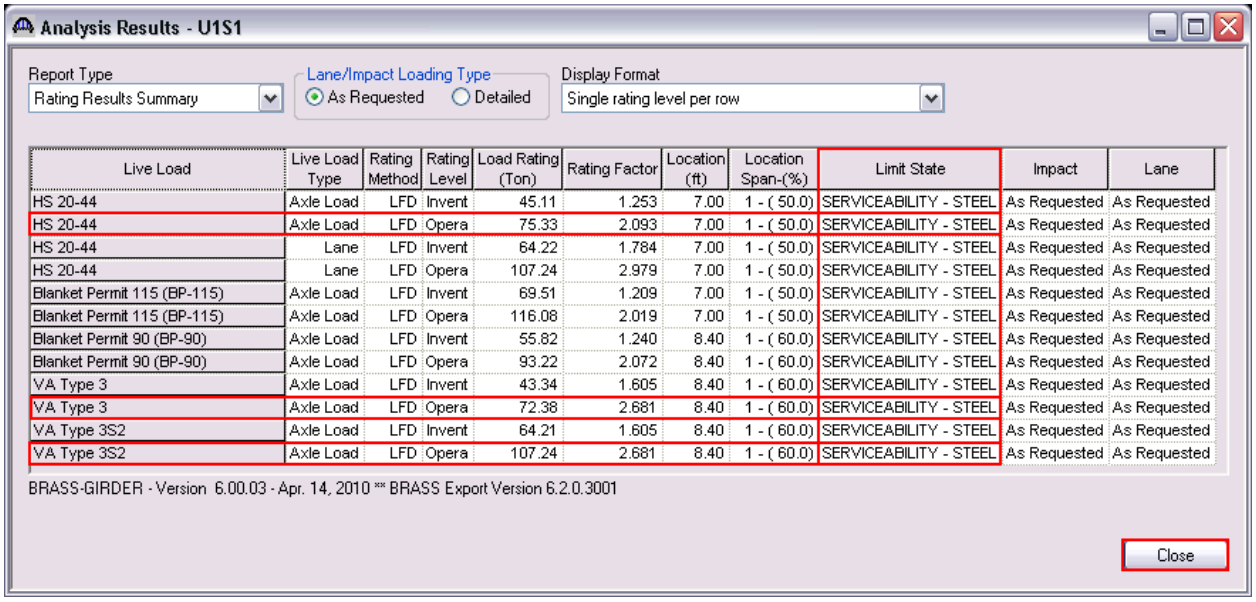



Highlight **U1S1 (E) (C)** and left click the **View Analysis Report** icon.

The **Analysis Results – U1S1** window will appear.

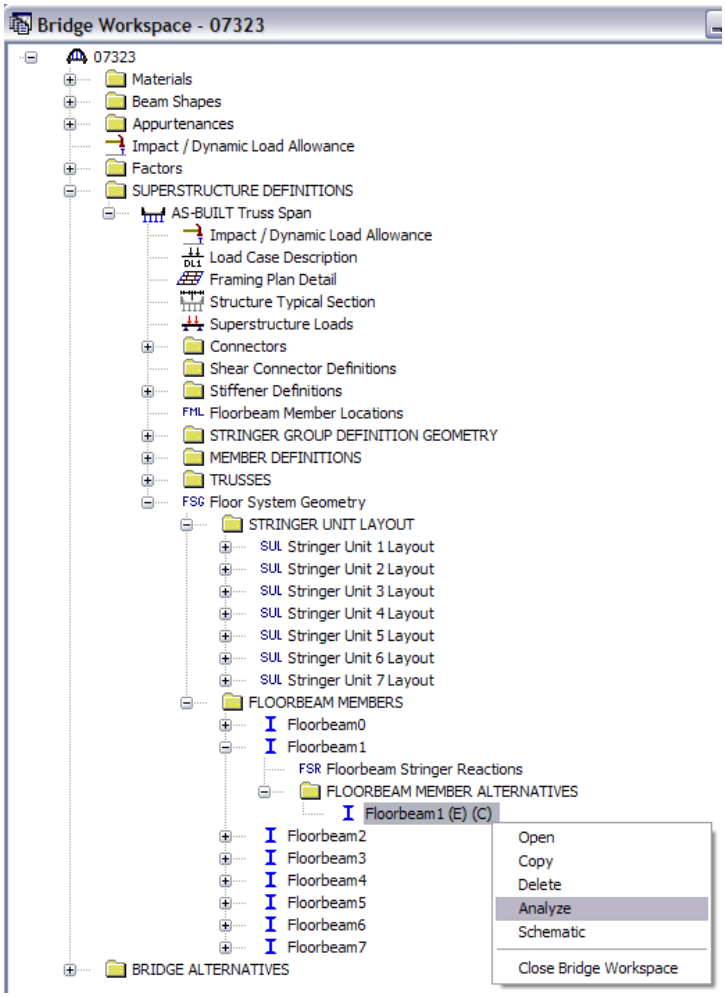
Select **Single rating level per row** from the **Display Format** drop down menu.


Analysis Results - U1S1
Report Type
Rating Results Summary
Lane/Impact Loading Type
As Requested
Detailed
Display Format
Mutiple rating levels per row
Mutiple rating levels per row
Single rating level per row
Live Load | Live Load Type | Rating Method | Inventory Load Rating (Ton) | Operating Load Rating (Ton) | Inventory Rating Factor | Operating Rating Factor | Inventory Location (ft) | Inventory Location Span-(%) | Operating Location (ft) | Operating Location Span-(%) | Inventory Limit State | Operating Limit State
HS 20-44 | Axle Load | LFD | 45.11 | 75.33 | 1.253 | 2.093 | 7.00 | 1 - ( 50.0) | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STI
HS 20-44 | Lane | LFD | 64.22 | 107.24 | 1.784 | 2.979 | 7.00 | 1 - ( 50.0) | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STI
Blanket Permit 115 (BP-115) | Axle Load | LFD | 69.51 | 116.08 | 1.209 | 2.019 | 7.00 | 1 - ( 50.0) | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STI
Blanket Permit 90 (BP-90) | Axle Load | LFD | 55.82 | 93.22 | 1.240 | 2.072 | 8.40 | 1 - ( 60.0) | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STI
VA Type 3 | Axle Load | LFD | 43.34 | 72.38 | 1.605 | 2.681 | 8.40 | 1 - ( 60.0) | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STI
VA Type 3S2 | Axle Load | LFD | 64.21 | 107.24 | 1.605 | 2.681 | 8.40 | 1 - ( 60.0) | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | SERVICEABILITY - STI
BRASS-GIRDER - Version 6.00.03 - Apr. 14, 2010 *** BRASS Export Version 6.2.0.3001
Close


Analysis Results - U1S1
Report Type
Rating Results Summary
Lane/Impact Loading Type
As Requested
Detailed
Display Format
Single rating level per row
Live Load | Live Load Type | Rating Method | Rating Level | Load Rating (Ton) | Rating Factor | Location (ft) | Location Span-(%) | Limit State | Impact | Lane
HS 20-44 | Axle Load | LFD | Invent | 45.11 | 1.253 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested
HS 20-44 | Axle Load | LFD | Opera | 75.33 | 2.093 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested
HS 20-44 | Lane | LFD | Invent | 64.22 | 1.784 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested
HS 20-44 | Lane | LFD | Opera | 107.24 | 2.979 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested
Blanket Permit 115 (BP-115) | Axle Load | LFD | Invent | 69.51 | 1.209 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested
Blanket Permit 115 (BP-115) | Axle Load | LFD | Opera | 116.08 | 2.019 | 7.00 | 1 - ( 50.0) | SERVICEABILITY - STEEL | As Requested | As Requested
Blanket Permit 90 (BP-90) | Axle Load | LFD | Invent | 55.82 | 1.240 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested
Blanket Permit 90 (BP-90) | Axle Load | LFD | Opera | 93.22 | 2.072 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested
VA Type 3 | Axle Load | LFD | Invent | 43.34 | 1.605 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested
VA Type 3 | Axle Load | LFD | Opera | 72.38 | 2.681 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested
VA Type 3S2 | Axle Load | LFD | Invent | 64.21 | 1.605 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested
VA Type 3S2 | Axle Load | LFD | Opera | 107.24 | 2.681 | 8.40 | 1 - ( 60.0) | SERVICEABILITY - STEEL | As Requested | As Requested
BRASS-GIRDER - Version 6.00.03 - Apr. 14, 2010 *** BRASS Export Version 6.2.0.3001
Close

The controlling force can be obtained from the Limit State column. Fill in the rating form as appropriate. See Appendix G for the completed rating form.

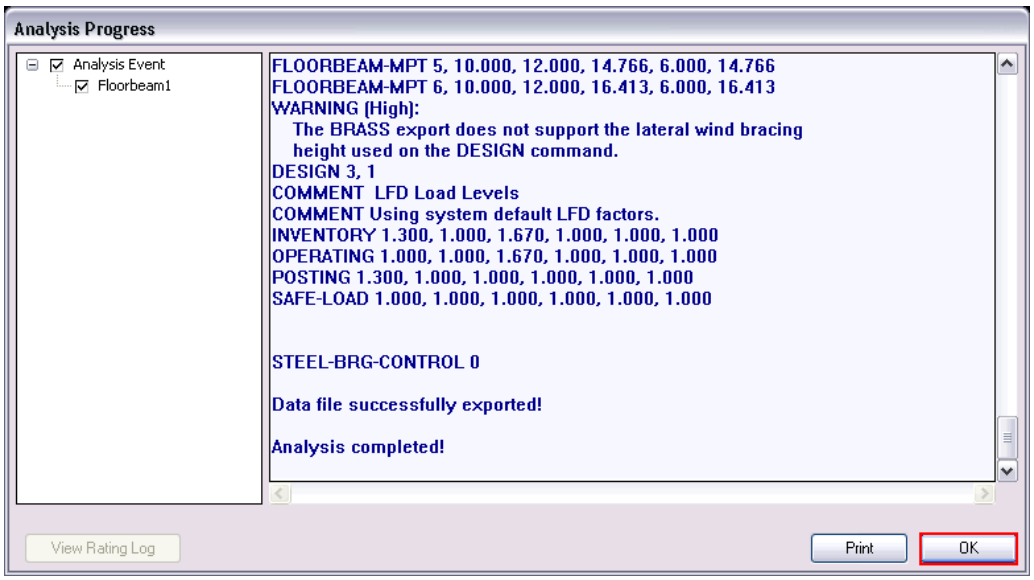
Left click the **Close** button.



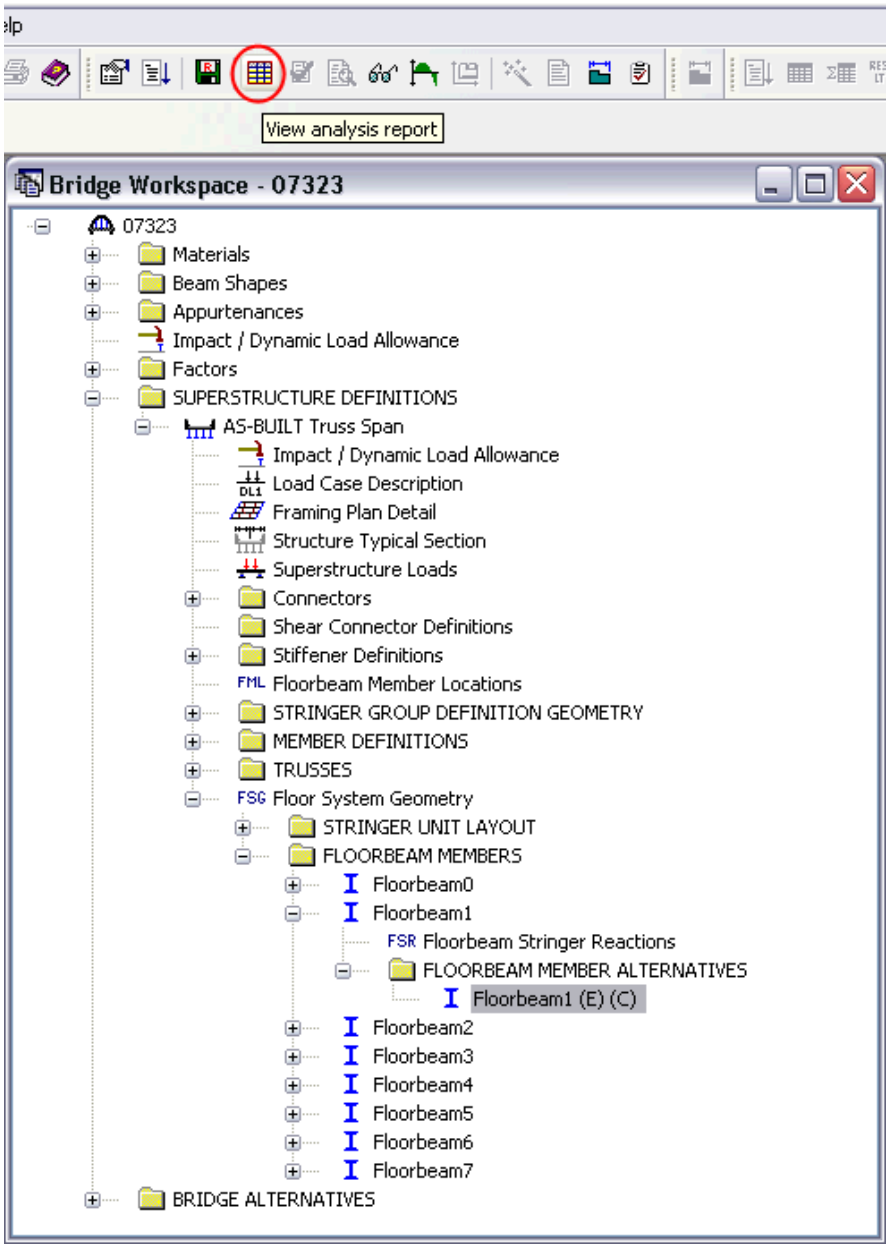

For the permit vehicles, the floorbeams controlled the rating.

Expand the folders to get to the controlling **MEMBER ALTERNATIVE**. For the example, this is the **interior stringers** and the **floorbeams**.

Right click any one of the **FLOORBEAM MEMBER ALTERNATIVES** and select **Analyze**.

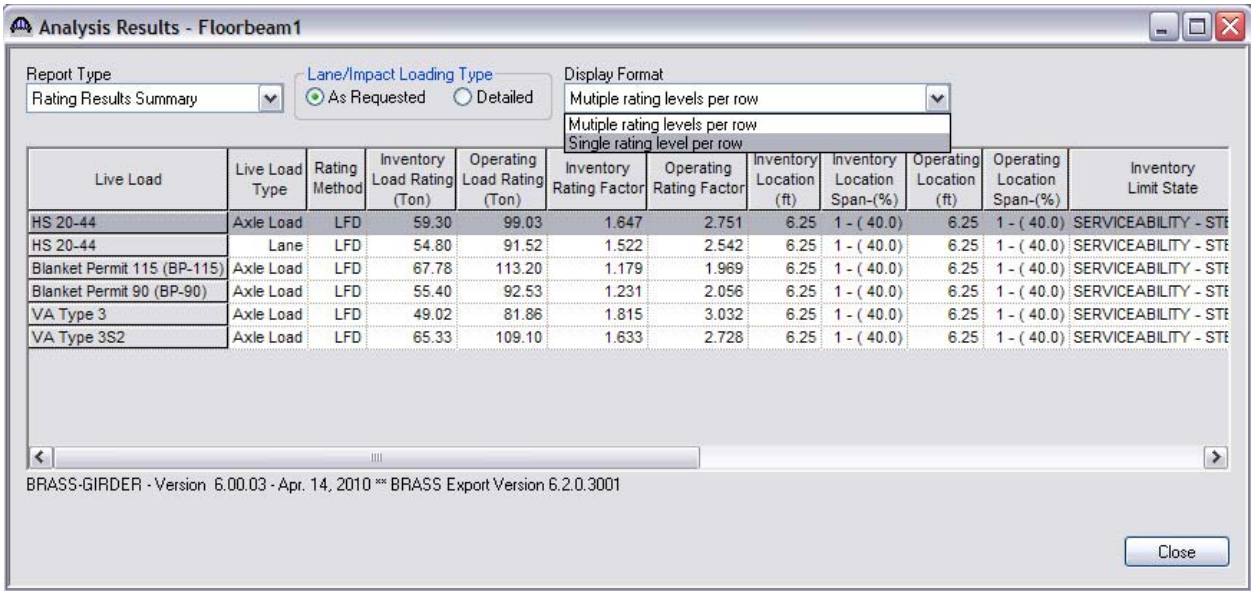

Analysis Progress
Analysis Event
Floorbeam1
FLOORBEAM-MPT 5, 10.000, 12.000, 14.766, 6.000, 14.766
FLOORBEAM-MPT 6, 10.000, 12.000, 16.413, 6.000, 16.413
WARNING (High):
The BRASS export does not support the lateral wind bracing
height used on the DESIGN command.
DESIGN 3, 1
COMMENT LFD Load Levels
COMMENT Using system default LFD factors.
INVENTORY 1.300, 1.000, 1.670, 1.000, 1.000, 1.000
OPERATING 1.000, 1.000, 1.670, 1.000, 1.000, 1.000
POSTING 1.300, 1.000, 1.000, 1.000, 1.000, 1.000
SAFE-LOAD 1.000, 1.000, 1.000, 1.000, 1.000, 1.000
STEEL-BRG-CONTROL 0
Data file successfully exported!
Analysis completed!
View Rating Log
Print
OK

Left click **OK** on the **Analysis Progress** window when the analysis is complete.

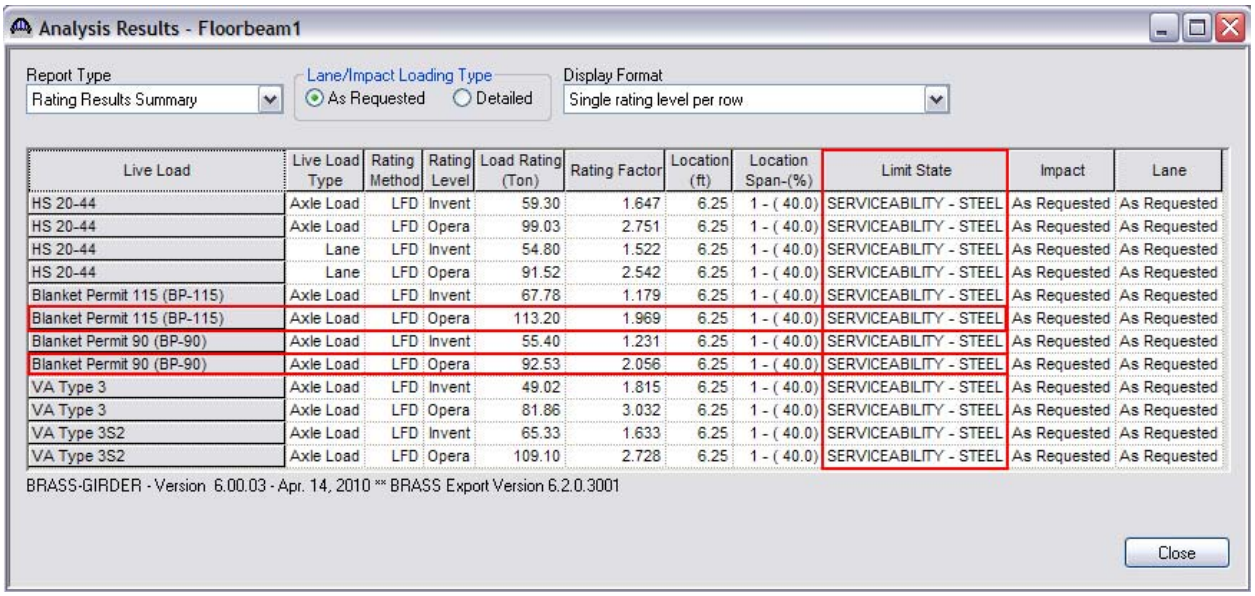



Highlight **Floorbeam1 (E) (C)** and left click the **View Analysis Report** icon.

The **Analysis Results – Floorbeam1** window will appear.

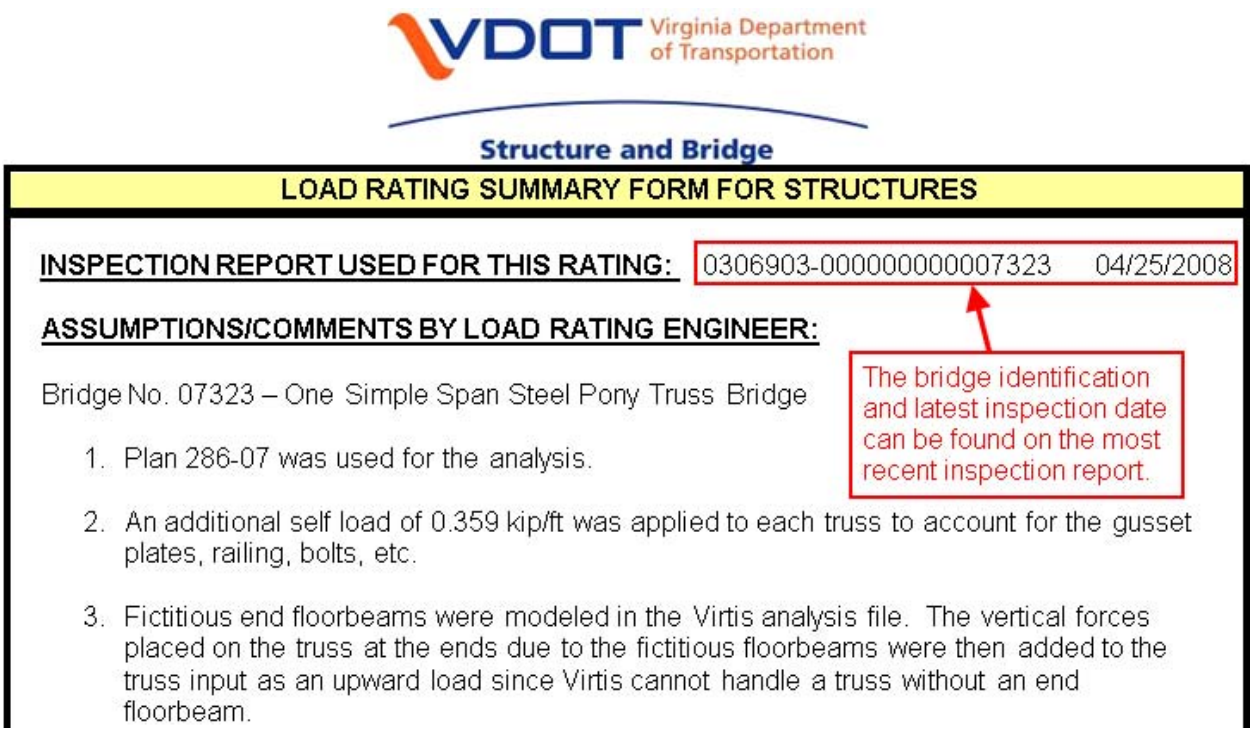

Analysis Results - Floorbeam1
Report Type
Rating Results Summary
Lane/Impact Loading Type
As Requested
Detailed
Display Format
Mutiple rating levels per row
Mutiple rating levels per row
Single rating level per row
Live Load | Live Load Type | Rating Method | Inventory Load Rating (Ton) | Operating Load Rating (Ton) | Inventory Rating Factor | Operating Rating Factor | Inventory Location (ft) | Inventory Location Span-(%) | Operating Location (ft) | Operating Location Span-(%) | Inventory Limit State
HS 20-44 | Axle Load | LFD | 59.30 | 99.03 | 1.647 | 2.751 | 6.25 | 1 - ( 40.0) | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STE
HS 20-44 | Lane | LFD | 54.80 | 91.52 | 1.522 | 2.542 | 6.25 | 1 - ( 40.0) | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STE
Blanket Permit 115 (BP-115) | Axle Load | LFD | 67.78 | 113.20 | 1.179 | 1.969 | 6.25 | 1 - ( 40.0) | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STE
Blanket Permit 90 (BP-90) | Axle Load | LFD | 55.40 | 92.53 | 1.231 | 2.056 | 6.25 | 1 - ( 40.0) | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STE
VA Type 3 | Axle Load | LFD | 49.02 | 81.86 | 1.815 | 3.032 | 6.25 | 1 - ( 40.0) | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STE
VA Type 3S2 | Axle Load | LFD | 65.33 | 109.10 | 1.633 | 2.728 | 6.25 | 1 - ( 40.0) | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STE
BRASS-GIRDER - Version 6.00.03 - Apr. 14, 2010 ** BRASS Export Version 6.2.0.3001
Close

Select **Single Rating Level per Row** from the **Display Format** drop down menu.


Analysis Results - Floorbeam1
Report Type
Rating Results Summary
Lane/Impact Loading Type
As Requested
Detailed
Display Format
Single rating level per row
Live Load | Live Load Type | Rating Method | Rating Level | Load Rating (Ton) | Rating Factor | Location (ft) | Location Span-(%) | Limit State | Impact | Lane
HS 20-44 | Axle Load | LFD | Invent | 59.30 | 1.647 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
HS 20-44 | Axle Load | LFD | Opera | 99.03 | 2.751 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
HS 20-44 | Lane | LFD | Invent | 54.80 | 1.522 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
HS 20-44 | Lane | LFD | Opera | 91.52 | 2.542 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
Blanket Permit 115 (BP-115) | Axle Load | LFD | Invent | 67.78 | 1.179 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
Blanket Permit 115 (BP-115) | Axle Load | LFD | Opera | 113.20 | 1.969 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
Blanket Permit 90 (BP-90) | Axle Load | LFD | Invent | 55.40 | 1.231 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
Blanket Permit 90 (BP-90) | Axle Load | LFD | Opera | 92.53 | 2.056 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
VA Type 3 | Axle Load | LFD | Invent | 49.02 | 1.815 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
VA Type 3 | Axle Load | LFD | Opera | 81.86 | 3.032 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
VA Type 3S2 | Axle Load | LFD | Invent | 65.33 | 1.633 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
VA Type 3S2 | Axle Load | LFD | Opera | 109.10 | 2.728 | 6.25 | 1 - ( 40.0) | SERVICEABILITY - STEEL | As Requested | As Requested
BRASS-GIRDER - Version 6.00.03 - Apr. 14, 2010 ** BRASS Export Version 6.2.0.3001
Close

The controlling force can be obtained from the Limit State column. Fill in the rating form as appropriate. See Appendix G for the completed rating form.

## COMPLETING THE RATING FORM: ASSUMPTIONS/COMMENTS



VDOT Virginia Department of Transportation

Structure and Bridge

LOAD RATING SUMMARY FORM FOR STRUCTURES

INSPECTION REPORT USED FOR THIS RATING: 0306903-000000000007323 04/25/2008

ASSUMPTIONS/COMMENTS BY LOAD RATING ENGINEER:

Bridge No. 07323 – One Simple Span Steel Pony Truss Bridge

1. Plan 286-07 was used for the analysis.
2. An additional self load of 0.359 kip/ft was applied to each truss to account for the gusset plates, railing, bolts, etc.
3. Fictitious end floorbeams were modeled in the Virtis analysis file. The vertical forces placed on the truss at the ends due to the fictitious floorbeams were then added to the truss input as an upward load since Virtis cannot handle a truss without an end floorbeam.



The second page of the rating form provides space for assumption and comments. Some common assumptions and comments are for material strengths, which plan was used, wearing surface thicknesses, and any deterioration or other changes applied to the structure.

If the current inspection report indicates that there is deterioration, the user will have to create an IR (inspection report) structure in addition to the AS-BUILT. For truss spans, the typical deterioration that warrants an IR structure is section loss to the stringers, floorbeams or truss members.

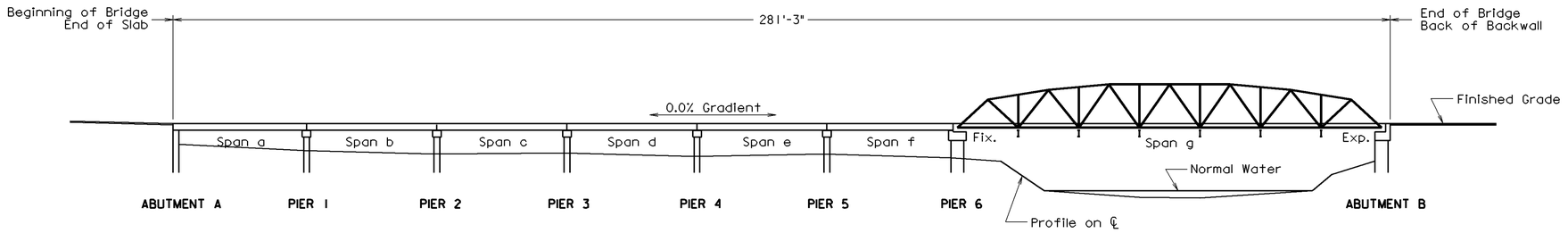
*****RATING FOR THE BRIDGE IS NOW COMPLETE.**

# APPENDIX A: DESIGN PLANS

| FHWA REGION | STATE | FEDERAL AID ROUTE | FEDERAL AID PROJECT | STATE ROUTE | STATE PROJECT | SHEET NO. |
|---|---|---|---|---|---|---|
| 3 | VA. | — | ——— | 645 | 0645-030-6903, SR01 | 1 |

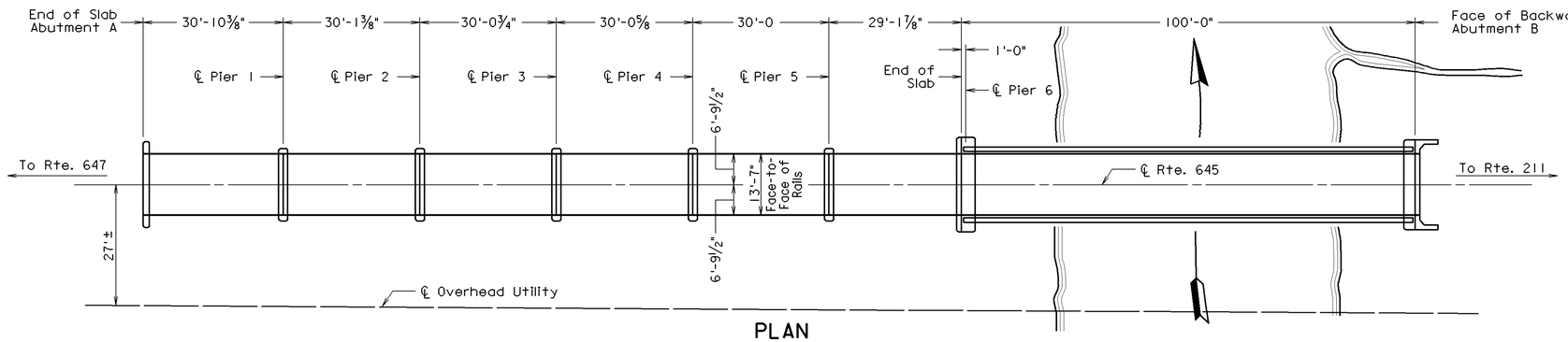
FHWA Construction and scour code X032-S8

PPMS NO.: None

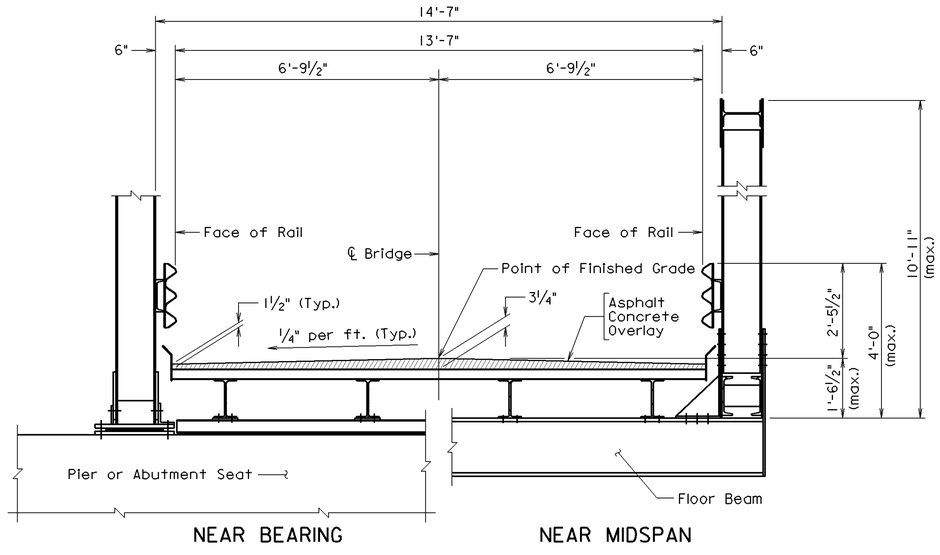



## ELEVATION
Section on ℄

Scale: 1/16" = 1'-0"

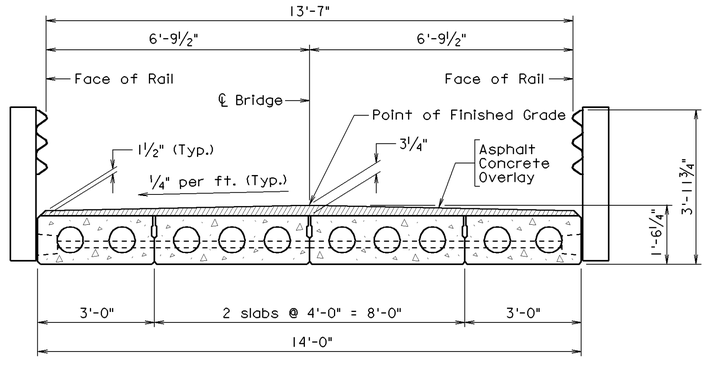



## PLAN
Scale: 1/16" = 1'-0"




## TRANSVERSE SECTION
Span g

Scale: ½" = 1'-0"




## TRANSVERSE SECTION
Spans a thru f

Scale: ½" = 1'-0"

## GENERAL NOTE:

Width: 13'-7" face-to-face of rails.

Span Layout: 6-30 ft. prestressed concrete slab spans, and 1-100 ft. prefabricated steel truss span.

Capacity: HS20-44 loading and alternate military loading.

Drainage Area: 47.62 sq. mi.

Specifications:

Construction: Virginia Department of Transportation Road and Bridge Specifications, 2002.

Design: AASHTO Standard Specifications for Highway Bridges, 1989; 1990 and 1991 Interim Specifications; and VDOT Modifications.

Standards: Virginia Department of Transportation Road and Bridge Standards, 2001.

These plans are incomplete unless accompanied by the Supplemental Specifications and Special Provisions included in the contract documents.

This project is to be constructed in accordance with the Virginia Department of Transportation Work Area Protection Manual, January 2003.

All structural steel, including bearings, shall be ASTM A709 Grade 50 and shall be galvanized

Concrete in prestressed members shall be Class A5. Concrete in substructure shall be Class A3.

Deformed reinforcing bars shall conform to ASTM A615, Grade 60; tie bars in piles may be Grade 40. All reinforcing bar dimensions on the detailed drawings are to centers of bars except where otherwise noted and are subject to fabrication and construction tolerances.

Bridge No. of existing structure is 6903. No existing plans available.

Prestressed concrete deck shall be waterproofed in accordance with the requirements of Sec. 405 and Sec. 416.

The existing structure is designated a Type B structure in accordance with Sec. 411.

B.M.:

# PRELIMINARY

COMMONWEALTH OF VIRGINIA

DEPARTMENT OF TRANSPORTATION

PROPOSED SUPERSTRUCTURE REPLACEMENT
RTE. 645 OVER RAPPAHANNOCK RIVER
FAUQUIER - RAPPAHANNOCK COUNTY LINE
PROJ: 0645-030-6903, SR01

| No. | Description | Date |
|---|---|---|
| | | |
| | | |
| | | |

REVISIONS

For Table of Revisions, see Sheet 2.

CULPEPER DISTRICT

| | |
|---|---|
| SUPERVISED: | DSP |
| DESIGNED: | PJU |
| DRAWN: | PJU |
| CHECKED: | xxx |

Recommended for Approval: _____
State Structure and Bridge Engineer

Approved: _____
Chief Engineer

Date: Dec. 28, 2004

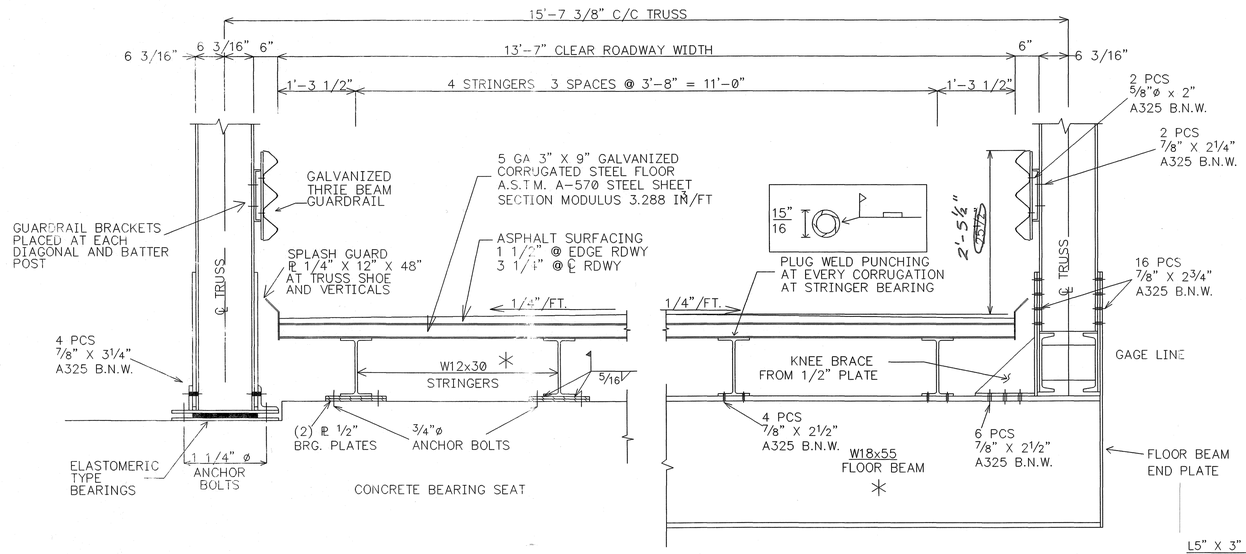
© 2004, Commonwealth of Virginia



286-07

050111

b28607001

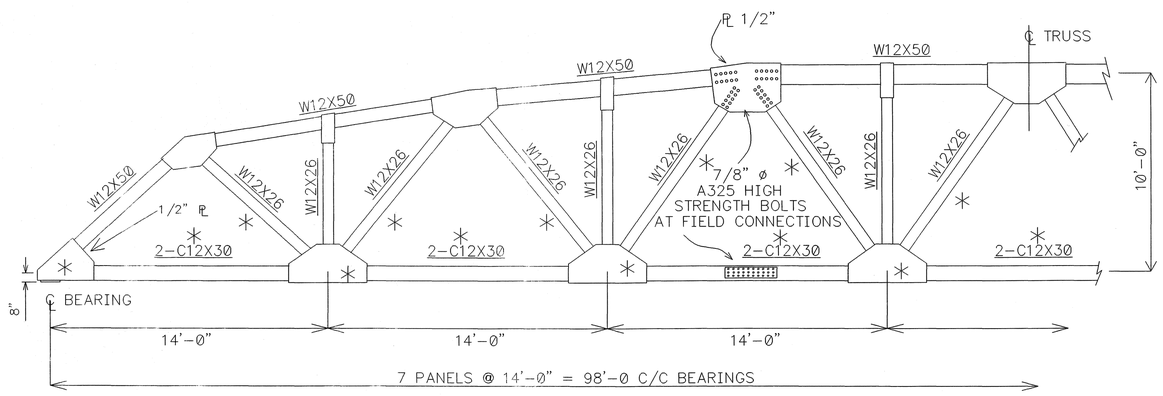

15'-7 3/8" C/C TRUSS
6 3/16"
6 3/16"
6"
13'-7" CLEAR ROADWAY WIDTH
6"
6 3/16"
1'-3 1/2"
4 STRINGERS 3 SPACES @ 3'-8" = 11'-0"
1'-3 1/2"
2 PCS 5/8"ø x 2" A325 B.N.W.
2 PCS 7/8" X 2 1/4" A325 B.N.W.
GALVANIZED THRIE BEAM GUARDRAIL
GUARDRAIL BRACKETS PLACED AT EACH DIAGONAL AND BATTER POST
5 GA 3" X 9" GALVANIZED CORRUGATED STEEL FLOOR A.S.T.M. A-570 STEEL SHEET SECTION MODULUS 3.288 IN³/FT
ASPHALT SURFACING 1 1/2" @ EDGE RDWY 3 1/4" @ ℄ RDWY
SPLASH GUARD ℙ 1/4" X 12" X 48" AT TRUSS SHOE AND VERTICALS
℄ TRUSS
15/16"
PLUG WELD PUNCHING AT EVERY CORRUGATION AT STRINGER BEARING
2'-5 1/2"
16 PCS 7/8" X 2 3/4" A325 B.N.W.
1/4"/FT.
1/4"/FT.
KNEE BRACE FROM 1/2" PLATE
GAGE LINE
4 PCS 7/8" X 3 1/4" A325 B.N.W.
W12x30 STRINGERS
5/16"
(2) ℙ 1/2" BRG. PLATES
3/4"ø ANCHOR BOLTS
4 PCS 7/8" X 2 1/2" A325 B.N.W.
W18x55 FLOOR BEAM
6 PCS 7/8" X 2 1/2" A325 B.N.W.
FLOOR BEAM END PLATE
ELASTOMERIC TYPE BEARINGS
1 1/4" ø ANCHOR BOLTS
CONCRETE BEARING SEAT

## TRUSS BRIDGE SECTION VIEWS

## TRUSS SHOE REACTION

| | |
|---|---|
| DEAD LOAD | 47.8K |
| LIVE LOAD | 39.7K |
| IMPACT | 8.9K |
| TOTAL | 96.4K |

✳ NOTE– DIAGONALS, BOTTOM CHORD CHANNELS, BOTTOM CHORD GUSSET PLATES, SPLICE PLATES, FLOOR BEAMS & STRINGERS REQUIRE NFC ZONE 2 CVN (15 FT–LBS @ 40° F)




## TRUSS BRIDGE DETAIL

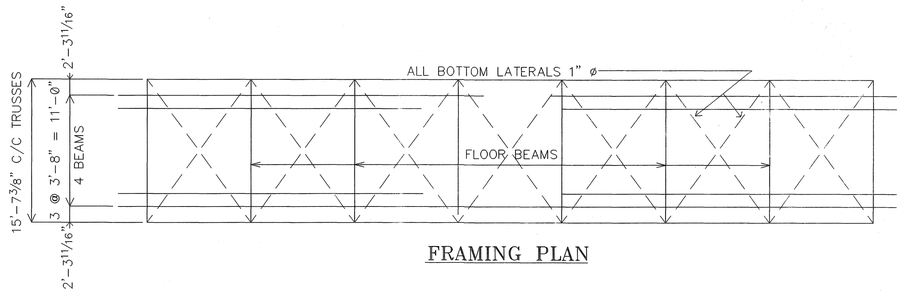
TRUSS LIFTING WEIGHT= 20.2K

## DESIGN DEAD LOADS

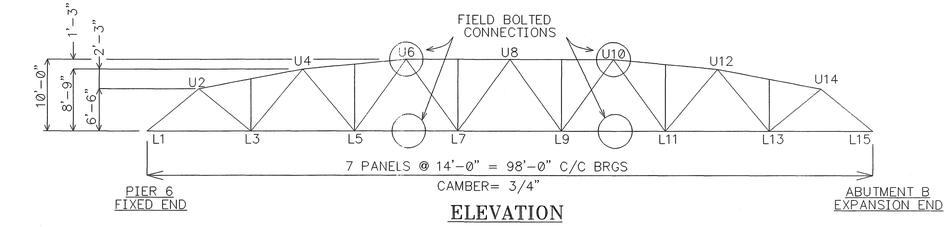
| | |
|---|---|
| STEEL FLOOR | 15 PSF |
| ASPHALT SURFACING | 50 PSF |
| FUTURE SURFACING | 35 PSF |

WELD MEMBERS TO GUSSET PLATES WITH MINIMUM 5/16 INCH FILLET WELDS AT EACH END OF EACH MEMBER.

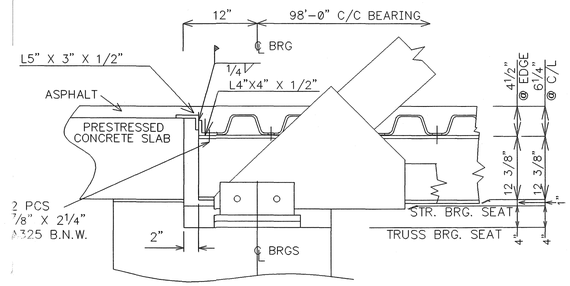
ALL GUSSET PLATES 3/8 INCH THICK EXCEPT AS NOTED WITH SUFFICIENT FLAT AREAS TO RESIST STRESSES AND SO SHAPED TO PRODUCE AN AESTHETIC ARCHITECTURAL APPEARANCE.



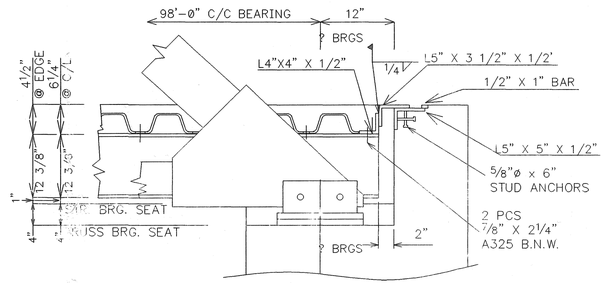

## FRAMING PLAN




## ELEVATION




## PIER 6 DETAIL




## ABUTMENT "B" DETAIL

## DESIGN SPECIFICATIONS

AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996; 1997 AND 1998 INTERIM SPECIFICATIONS; AND VDOT MODIFICATIONS USING ALLOWABLE STRESS DESIGN

## LIVE LOAD

AASHTO HS20–44 AND ALTERNATE MILITARY LOADING

## MATERIAL

ALL STRUCTURAL STEEL SHALL BE ASTM A709 GRADE 50 AND SHALL BE GALVANIZED .

ALL TRUSS MEMBERS, INCLUDING GUSSET AND SPLICE PLATES, FLOOR BEAMS, STRINGERS AND ANY OTHER COMPONENTS DESIGNATED AS MAIN LOAD CARRYING MEMBERS SUBJECT TO CALCULATED TENSION OR STRESS REVERSAL, SHALL MEET THE ZONE 2 CHARPY V NOTCH IMPACT STRENGTH REQUIREMENTS AS SPECIFIED IN SECTION 226 OF THE SPECIFICATIONS.

FIELD SPLICES OF THE TRUSS AND ALL FLOOR BEAM CONNECTIONS SHALL BE MADE USING HIGH STRENGTH BOLTS, AND SHALL BE DESIGNED AS SLIP–CRITICAL CONNECTION WITH A CLASS C SURFACE.

ALL FASTENERS SHALL BE 7/8" DIAMETER HIGH STRENGTH BOLTS, ASTM A325 GALVANIZED WITH A563 GRADE DH NUT AND ONE F436 WASHER PER BOLT AND MANUFACTURED IN ACCORDANCE WITH SECTION 226. THEY SHALL BE HOT DIPPED GALVANIZED PER SECTION 226.04(h) 3e OF THE VDOT ROAD & BRIDGE SPECIFICATIONS. ALL FASTENERS IN CONTACT WITH GALVANIZED STEEL, UNLESS OTHERWISE NOTED, SHALL BE 7/8" DIAMETER HIGH STRENGTH BOLTS, ASTM A325, A563 GRADE DH3 NUT AND ONE F436 WASHER PER BOLT AND MANUFACTURED IN ACCORDANCE WITH SECTION 226.

VIRGINIA DEPARTMENT OF TRANSPORTATION
REVIEW OF WORKING DRAWINGS

WORKING DRAWINGS HAVE BEEN REVIEWED IN ACCORDANCE WITH SECTION 105.02 OF THE SPECIFICATIONS WITH THE FOLLOWING COMMENTS:
☑ REVIEW COMPLETED.
☐ CORRECT AND RESUBMIT.
☐ REJECTED-SEE REMARKS.
REVIEWED: BRENT SPRINKEL
CULPEPER DIST. BRIDGE ENGR.
BY: PJM
DATE: 10-11-05

## CONSTRUCTION/FABRICATION

~~AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 1996; 1997 AND 1998 INTERIM SPECIFICATIONS; AND~~ VDOT ROAD AND BRIDGE SPECIFICATIONS, 2002.

WELDING

ALL WELDING SHALL BE IN ACCORDANCE WITH AASHTO/AWS D1.5 BRIDGE WELDING CODE AND THE AASHTO FRACTURE CONTROL, WHERE APPLICABLE. ALL WELDING ON TRUSS SHALL BE DONE PRIOR TO GALVANIZATION AND FIELD WELDING IS NOT PERMITTED

WELDING PROCESS SHALL BE MANUAL SHIELDED METAL ARC WELDING (SMAW) USING LOW HYDROGEN ELECTRODES CLASSIFIED E7028

NON–DESTRUCTIVE TESTING OF WELDS SHALL BE PERFORMED AS FOLLOWS:

FILLET WELDS – VISUAL – 100%
– MT. – 10% MIN

ALL GALVANIZING THAT HAS BEEN CHIPPED OR DAMAGED DURING HANDLING OR WELDING SHALL BE POWER BRUSHED AND PAINTED BY THE CONTRACTOR WITH TWO COATS OF PAINT MEETING THE REQUIREMENTS OF SECTION 233.03 OF THE SPECIFICATIONS. SPRAY CANS SHALL NOT BE USED.

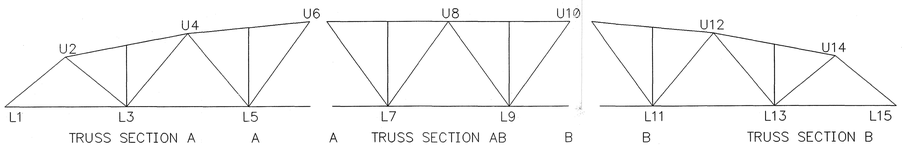
NOTE: DRAWINGS RELATIVE DO NOT SCALE

| NO. | DATE | REVISIONS | BY |
|---|---|---|---|
| 1 | 9/26/05 | VDOT REVISIONS | RES |

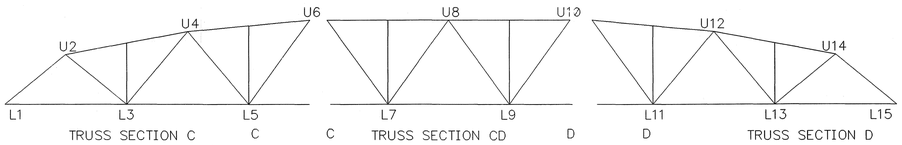
98'–0" TRUSS BRIDGE 13'–7" RDWY
RT. 645 OVER RAPPAHANNOCK RIVER
VDOT PROJ. NO. 0645–030–6903, SR01
FAUQUIER COUNTY, VIRGINIA

| DESIGN | DRAWN | DATE | DRAWING NO. | SHEET |
|---|---|---|---|---|
| AG | RES | AUG. 30, 2005 | WARRENTON TRUSS | 1 OF 110 7 |
| CHECK/DATE AG 9/2/05 | FABRICATOR U.S. BRIDGE | | | |

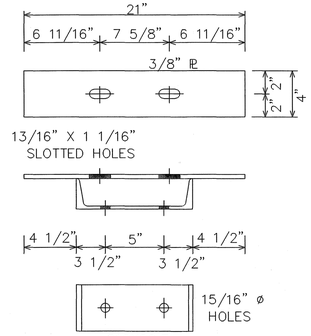
| BOLT CHART | BOLT TYPE – 7/8"ø A325 TYPE 1 GALVANIZED | | | | | |
|---|---|---|---|---|---|---|
| | SIZE | | | | | |
| LOCATION | 2 1/4" | 2 1/2" | 2 3/4" | 3" | 3¼" | |
| FLOOR BEAM TO TRUSS | | | 96 | | | |
| KNEE BRACE TO TRUSS | | | 96 | | | |
| KNEE BRACE TO FLOOR BEAM | | 72 | | | | |
| STRINGER TO FLOOR BEAM | | 96 | | | | |
| SHELF ANGLE TO STRINGER | 16 | | | | | |
| TRUSS BRG. TO TRUSS | | | | | 16 | |
| GUARDRAIL BRACKET TO TRUSS | 56 | | | | | |
| L5–L7 & L9–L11 BOTTOM CHORD SPLICE | | | | 240 | | |
| U6 & U10 TOP CHORD SPLICE | 160 | | | 160 | | |
| TOTAL REQ'D | 232 | 168 | 192 | 400 | 16 | |
| TOTAL ORDERED | 244 | 178 | 202 | 420 | 26 | |



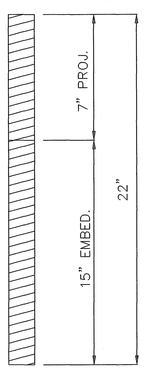

TRUSS 1
TRUSS MARKING DIAGRAM



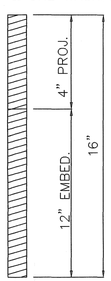

TRUSS 2
TRUSS MARKING DIAGRAM




GUARDRAIL BRACKET
28 REQ'D




TRUSS ANCHOR BOLT
8 REQ'D
GALVANIZED




STRINGER ANCHOR BOLT
16 REQ'D
GALVANIZED

| | MATERIAL SCHEDULE | |
|---|---|---|
| QUANTITY | DESCRIPTION | |
| 1 PC. | TRUSS 1 – SECTION A | GALVANIZED |
| 1 PC. | TRUSS 1 – SECTION AB | GALVANIZED |
| 1 PC. | TRUSS 1 – SECTION B | GALVANIZED |
| 1 PC. | TRUSS 2 – SECTION C | GALVANIZED |
| 1 PC. | TRUSS 2 – SECTION CD | GALVANIZED |
| 1 PC. | TRUSS 2 – SECTION D | GALVANIZED |
| 6 PCS | FLOOR BEAMS–W18X55 @ 16'–8 1/2" ;4 PCS. – PL 3/4" X 6" X 8 11/16" 2 PCS. – PL 1/2" X 10" X 44 3/4" | CVN & GALVANIZED |
| 20 PCS | INTERIOR PANEL STRINGERS – W12 X 30 @ 13'– 11 1/2" | CVN & GALVANIZED |
| 8 PCS | END PANEL STRINGERS – W12 X 30 @ 14'–9 3/4" | CVN & GALVANIZED |
| 12 PCS | KNEE BRACE ASSEMBLY; 1 PC. – PL 1/2" X 7 1/2" X 26"; 1 PC. – PL 1/2" X 14" X 14" – TRIANGULAR CUT 1 PC. – PL 1/2" X 7 1/2" X 14" | GALVANIZED |
| 14 PCS | LATERAL RODS – 1" ROUND X 18'–7" WITH 2 WASHERS & 2 NUTS | GALVANIZED |
| 2 PCS | SHELF ANGLE – L 4" X 4" X 1/2" @ 13'–7" | GALVANIZED |
| 1 PC | ABUTMENT OVER ANGLE – L 5" X 3 1/2" X 1/2" @ 13'–7" | GALVANIZED |
| 1 PC | PIER 6 OVER ANGLE – L 5" X 3" X 1/2" @ 13'–7" | GALVANIZED |
| 1 PC | ABUTMENT ANGLE – L 5" X 5" X 1/2" @ 13'–9"; 1 PC BAR ½"x1"x13'–9" WITH 5/8"ø x 6" STUDS | GALVANIZED |
| 16 PCS | BOTTOM CHORD SPLICE PLATE– ½"x9"x50" | GALVANIZED |
| 2 PCS | TRUSS BEARING ASSEMBLIES (FIXED END) | GALVANIZED |
| 2 PCS | TRUSS BEARING ASSEMBLIES (EXPANSION END) | GALVANIZED |
| 4 PCS | TRUSS BEARING ANGLE– L6x6x3/4 @ 14" | GALVANIZED |
| 16 PCS | STRINGER BEARING PLATES– PL 1/2"x8"x18" | GALVANIZED |
| 4 PCS | LATERAL ROD ANCHOR PLATE– PL ½"x8"x10" | GALVANIZED |
| 4 PCS | LATERAL ROD ANCHOR ANGLE– L8"x4"x½" @ 8" | GALVANIZED |
| 244 PCS | A325 TYPE 1 GALVANIZED B, N, W – 7/8" ø X 2 1/4" | |
| 178 PCS | A325 TYPE 1 GALVANIZED B, N, W – 7/8" ø X 2 1/2" | |
| 202 PCS | A325 TYPE 1 GALVANIZED B, N, W – 7/8" ø X 2 3/4' | |
| 420 PCS | A325 TYPE 1 GALVANIZED B, N, W – 7/8" ø X 3" | |
| 26 PCS | A325 TYPE 1 GALVANIZED B, N, W – 7/8" ø X 3 1/4" | |
| 16 PCS | ANCHOR BOLT – 3/4" ø X 16" | GALVANIZED |
| 8 PCS | ANCHOR BOLT – 1 1/2" ø X 22" | GALVANIZED |
| 67 PCS | 5 GA 3" X 9" GALVANIZED BRIDGE FLOOR @ 13'–7" | |
| 16 PCS | SPLASH GUARD PL 1/4" X 12" X 4'–0" | GALVANIZED |
| 18 PCS | END DAM PLATE– PL 3/16"x5"x12'–0" | GALVANIZED |
| 56 PCS | 5/8"ø X 2" GUARDRAIL MOUNTING BOLT (GALVANIZED) | |
| 240 PCS | 5/8"ø X 1 1/4" GUARDRAIL SPLICE BOLT (GALVANIZED) | |
| 40 PCS | 5/8"ø X 9¼" GUARDRAIL WOOD POST BOLT (GALVANIZED) | |
| 18 PCS | GALVANIZED THRIEBEAM GUARDRAIL @ 12'–6" (10 Gage) | |
| 2 PCS | GALVANIZED TRANSITION SECTION @ 6'–3" | |
| 10 PCS | W6X9 GUARDRAIL POST @ 7'–0"; 1 PC 6"x8"x21⅝" WOOD BLOCKOUT | |
| 72 PCS | SPECIAL WASHER PL 3/16"x1¾"x3" W/ 11/16" x 1" SLOTTED HOLE | GALVANIZED |
| 28 PCS | G.R. BRACKET– 1 PC C12X20.7 @ 4"; 1 PC PL ⅜"x4"x21" | GALVANIZED |
| 16 PCS | BOTTOM CHORD SPLICE PLATE– PL ½"x9"x38" | GALVANIZED |
| 16 PCS | TOP CHORD INSIDE GUSSET PLATE– PL ½"x3" | GALVANIZED |

VIRGINIA DEPARTMENT OF TRANSPORTATION
REVIEW OF WORKING DRAWINGS

WORKING DRAWINGS HAVE BEEN REVIEWED IN ACCORDANCE WITH SECTION 105.02 OF THE SPECIFICATIONS WITH THE FOLLOWING COMMENTS:
☒ REVIEW COMPLETED.
☐ CORRECT AND RESUBMIT.
☐ REJECTED-SEE REMARKS.
REVIEWED: BRENT SPRINKEL
CULPEPER DIST. BRIDGE ENGR.
BY: RJH
DATE: 10-11-05

NOTE: DRAWINGS RELATIVE DO NOT SCALE

| NO. | DATE | REVISIONS | BY |
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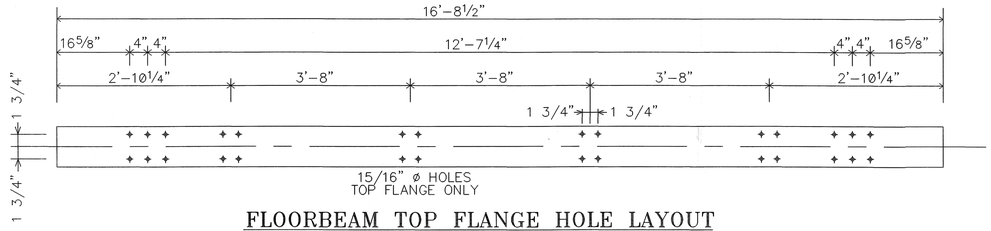
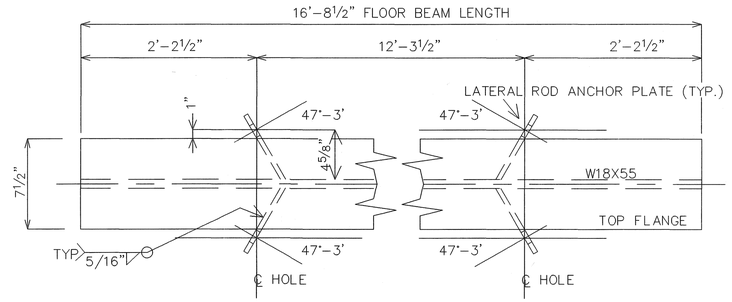
98'–0" TRUSS BRIDGE 13'–7" RDWY
RT. 645 OVER RAPPAHANNOCK RIVER
VDOT PROJ. NO. 0645–030–6903, SR01
FAUQUIER COUNTY, VIRGINIA

| DESIGN | DRAWN | DATE | DRAWING NO. | SHEET |
|---|---|---|---|---|
| AG | RES | AUG. 30, 2005 | WARRENTON TRUSS | 2 OF 117 |
| CHECK/DATE AG 9/2/05 | FABRICATOR U.S. BRIDGE | | | |

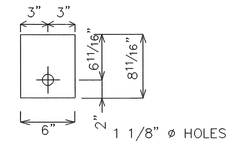



## FLOORBEAM TOP FLANGE HOLE LAYOUT

W18X55
6 REQ'D.
GALVANIZED
(CVN)

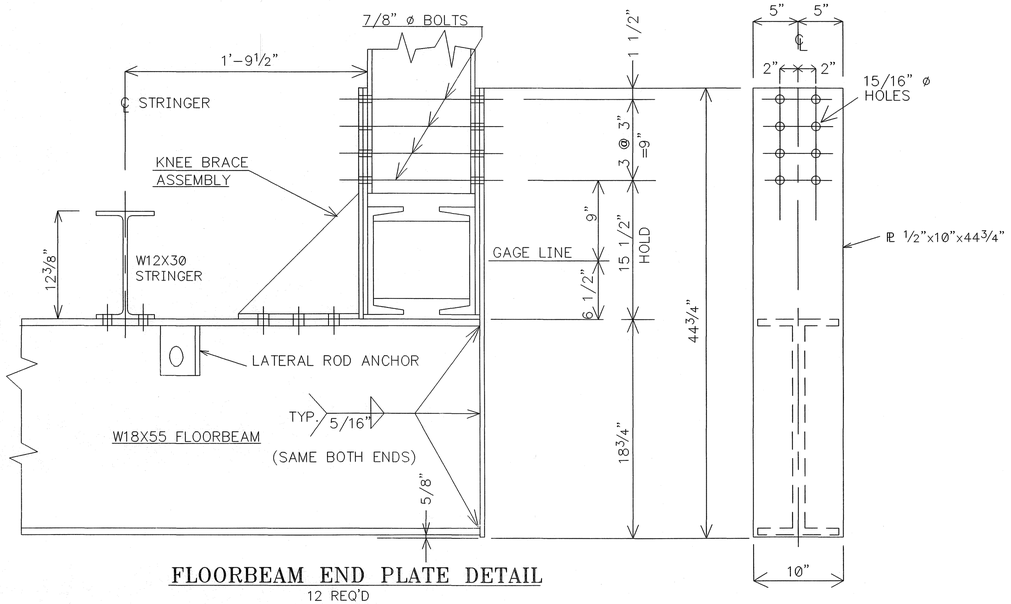



## LATERAL ROD ANCHOR LAYOUT



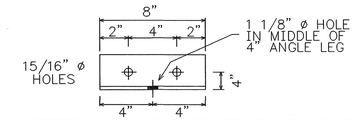

## INTERIOR PANEL LATERAL ROD ANCHOR PLATE

℗ 3/4"x6"x8 11/16"
24 REQ'D
GALVANIZED



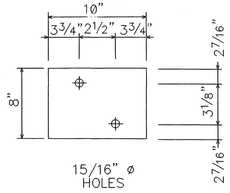

## FLOORBEAM END PLATE DETAIL

12 REQ'D
GALVANIZED



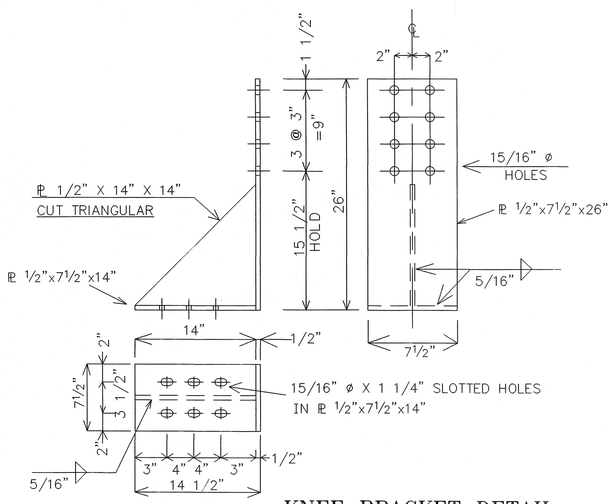

## LATERAL ROD ANCHOR ANGLE

L 8" X 4" X 1/2"
4 REQ'D



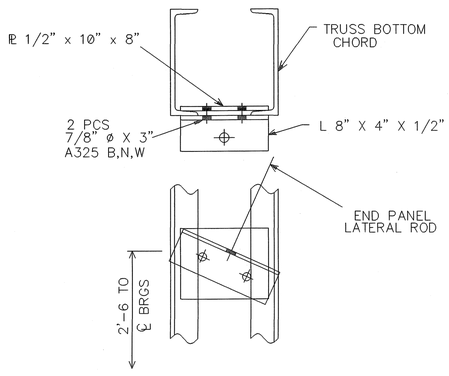

## LATERAL ROD ANCHOR PLATE

℗ 1/2" x 8" x 10"
4 REQ'D

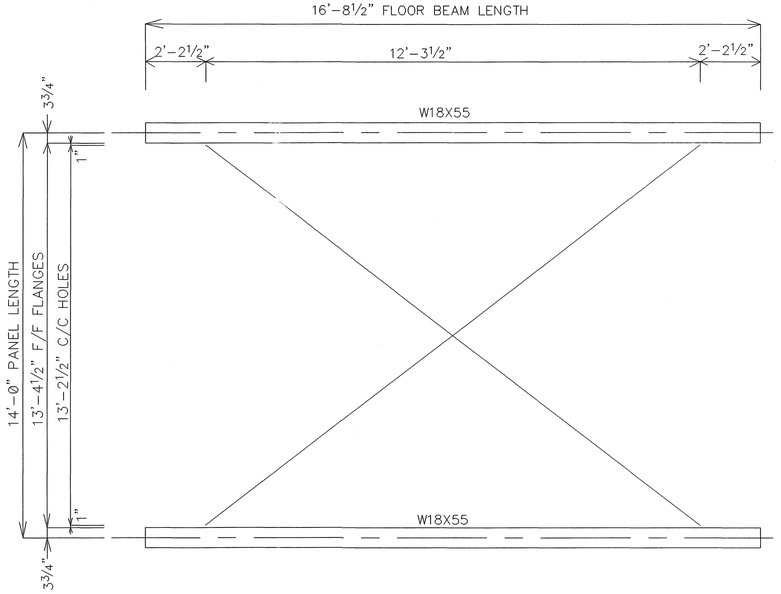



## KNEE BRACKET DETAIL

12 REQ'D
GALVANIZED




## END PANEL LATERAL ROD ANCHOR DETAIL




VIRGINIA DEPARTMENT OF TRANSPORTATION
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REVIEWED: BRENT SPRINKEL
CULPEPER DIST. BRIDGE ENGR.
BY: PJH
DATE: 10-11-05

ANGLE CALC. $= \frac{13.208}{12.29} = 1.074 = 47.06^\circ = 47°-3'$

LENGTH CALC. $= \frac{12.29}{\cos 47.06^\circ} = 18.04' = 18'-0\ 1/2"$

## LATERAL ROD LENGTHS

14 PCS – 1" ø ROD – 18'-7" LONG WITH 6" THREAD EACH END

NOTE: DRAWINGS RELATIVE DO NOT SCALE

| NO. | DATE | REVISIONS | BY |
|---|---|---|---|
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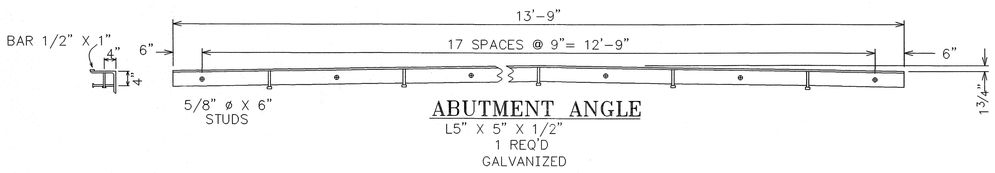
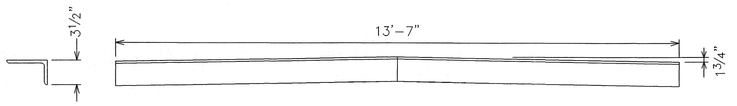
98'-0" TRUSS BRIDGE 13'-7" RDWY
RT. 645 OVER RAPPAHANNOCK RIVER
VDOT PROJ. NO. 0645-030-6903, SR01
FAUQUIER COUNTY, VIRGINIA

| DESIGN | DRAWN | DATE | DRAWING NO. | SHEET |
|---|---|---|---|---|
| AG | RES | AUG. 30, 2005 | WARRENTON TRUSS | 3 OF 112 |
| CHECK/DATE AG 9/2/05 | FABRICATOR U.S. BRIDGE | | | |



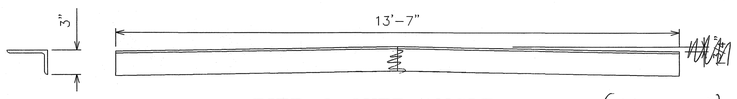

## ABUTMENT ANGLE

L5" X 5" X 1/2"
1 REQ'D
GALVANIZED




## ABUTMENT OVER ANGLE

L5" X 3 1/2" X 1/2"
1 REQ'D
GALVANIZED




## PIER 6 OVER ANGLE

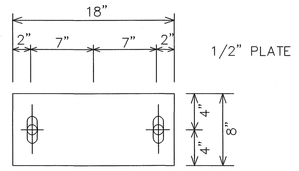
(Not Grouned)

L5" X 3" X 1/2"
1 REQ'D




## SHELF ANGLE

L4X4X1/2
2 REQ'D
GALVANIZED



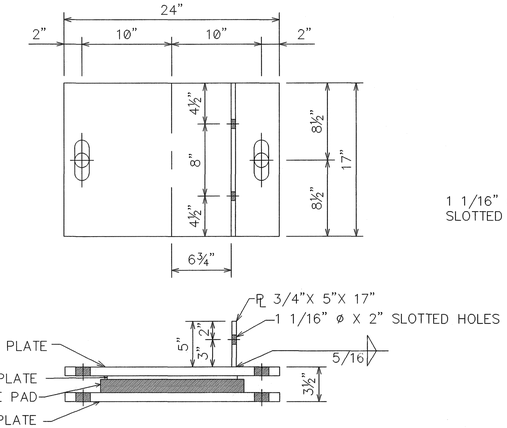

## BEARING PLATE DETAIL

FIXED END

4 PLATES WITH 1 1/8" ø HOLES – TOP PLATES
4 PLATES WITH 1 1/8" ø HOLES – BOTTOM PLATES

EXPANSION END

4 PLATES WITH 1 1/8" X 3" SLOTTED HOLES – TOP PLATES
4 PLATES WITH 1 1/8" ø HOLES – BOTTOM PLATES



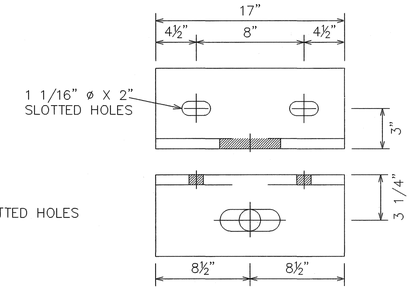

## TRUSS BEARING PLATES

FIXED BEARINGS

SOLE PLATE – 2 PCS – PL 1" X 17" X 24" WITH 1 5/8"ø HOLES
CON-SLIDE PADS – 2 PCS – 1 1/2" X 15" X 14 1/2"
MASONRY PLATE – 2 PCS – PL 1" X 17" X 24" WITH 1 5/8"ø HOLES

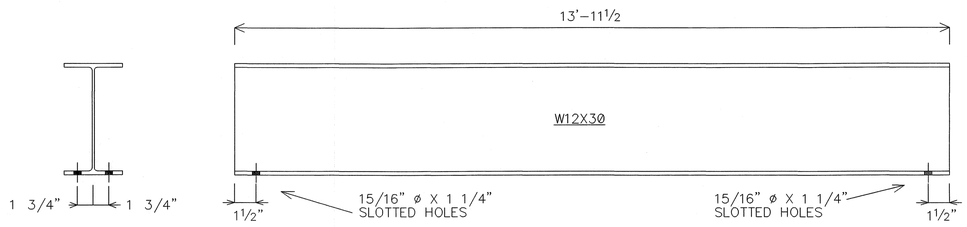
EXPANSION BEARINGS

SOLE PLATE – 2 PCS – PL 3/4" X 17" X 24" WITH 1 5/8"ø X 4 1/2" SLOTTED HOLES
SLIDING PLATE – 2 PCS – PL 3/8" X 16 1/2" X 16" WITH 20 GA STAINLESS STEEL PLATE BONDED TO THE BOTTOM
CON-SLIDE PADS – 2 PCS – 1 1/2" X 15" X 14 1/2" WITH PTFE SURFACING
MASONRY PLATE – 2 PCS – PL 3/4" X 17" X 24" WITH 1 5/8"ø HOLES



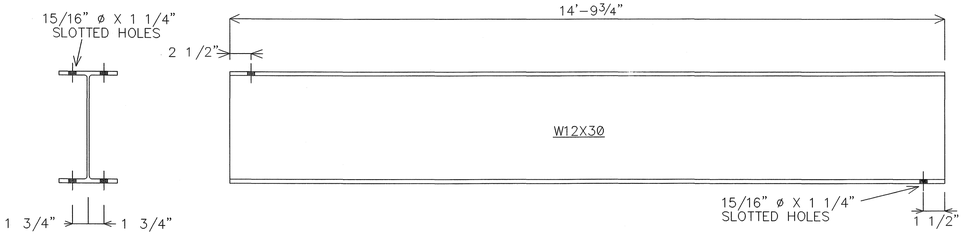

## TRUSS BEARING ANGLES

L6X6X3/4
2 WITH 1 5/8" X 4 1/2" SLOTTED HOLES
2 WITH 1 5/8"ø HOLES




## INTERIOR PANEL STRINGERS

20 REQ'D
GALVANIZED
(CVN)




## ABUTMENT END PANEL STRINGERS

8 REQ'D
GALVANIZED
(CVN)

VIRGINIA DEPARTMENT OF TRANSPORTATION
REVIEW OF WORKING DRAWINGS

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☒ REVIEW COMPLETED. BY: PJH
☐ CORRECT AND RESUBMIT.
☐ REJECTED-SEE REMARKS. DATE: 10-11-05

REVIEWED: BRENT SPRINKEL
CULPEPER DIST. BRIDGE ENGR.

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| CHECK/DATE AG 9/2/05 | FABRICATOR U.S. BRIDGE | | | |

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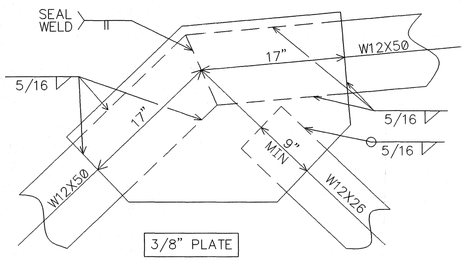
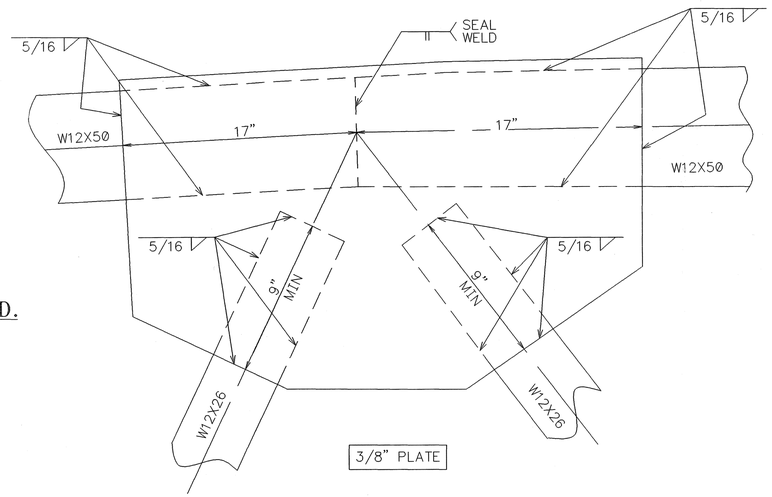
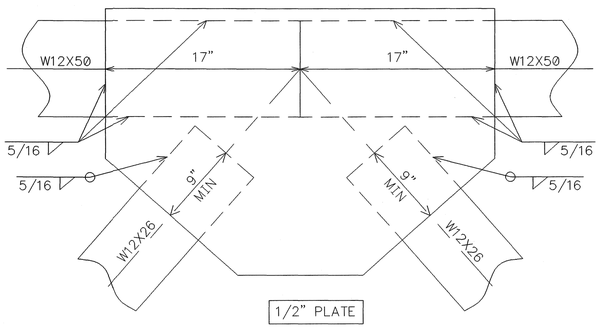


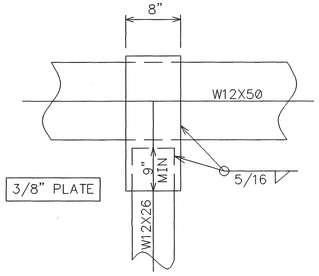

U2 & U14 GUSSET PLATES- 8 REQ'D.



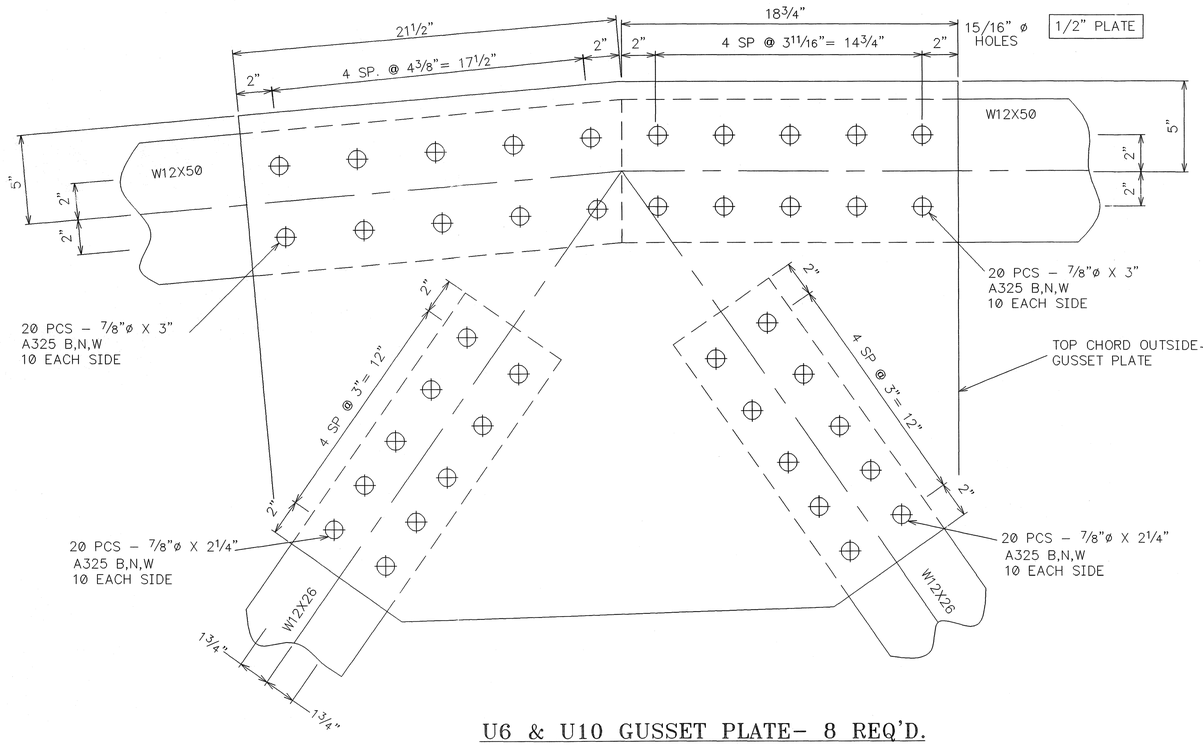

U4 & U12 GUSSET PLATES- 8 REQ'D.



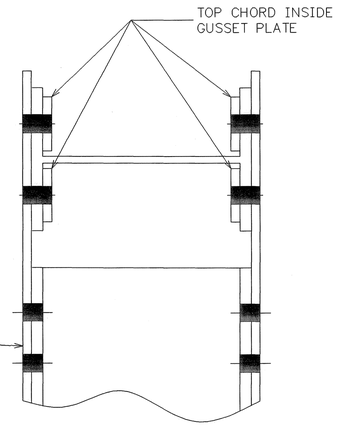

U8 GUSSET PLATE- 4 REQ'D.




VERTICAL GUSSET PLATES



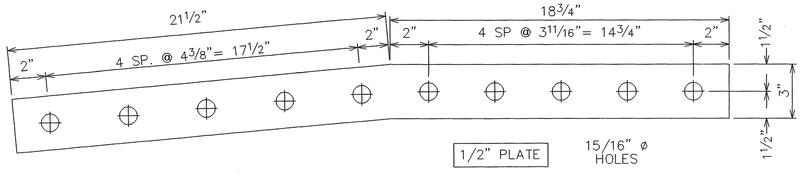

U6 & U10 GUSSET PLATE- 8 REQ'D.




VIRGINIA DEPARTMENT OF TRANSPORTATION
REVIEW OF WORKING DRAWINGS

WORKING DRAWINGS HAVE BEEN REVIEWED IN ACCORDANCE WITH SECTION 105.02 OF THE SPECIFICATIONS WITH THE FOLLOWING COMMENTS:

☒ REVIEW COMPLETED. BY: PJM
☐ CORRECT AND RESUBMIT.
☐ REJECTED-SEE REMARKS. DATE: 10-11-05
REVIEWED: BRENT SPRINKEL
CULPEPER DIST. BRIDGE ENGR.



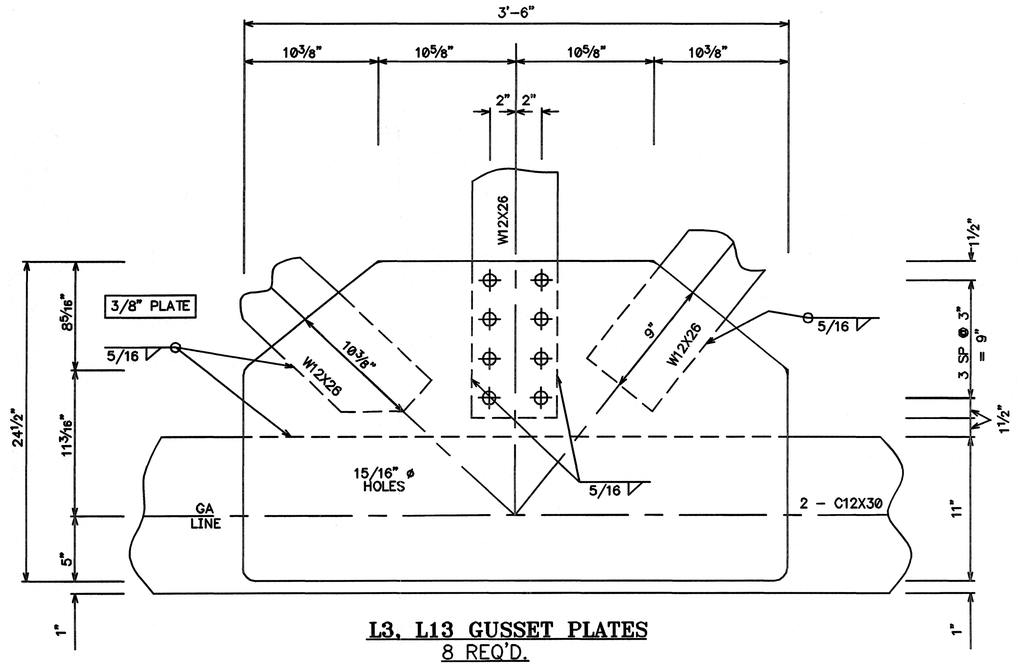

TOP CHORD INSIDE GUSSET PLATE- 16 REQ'D.

NOTE: DRAWINGS RELATIVE DO NOT SCALE

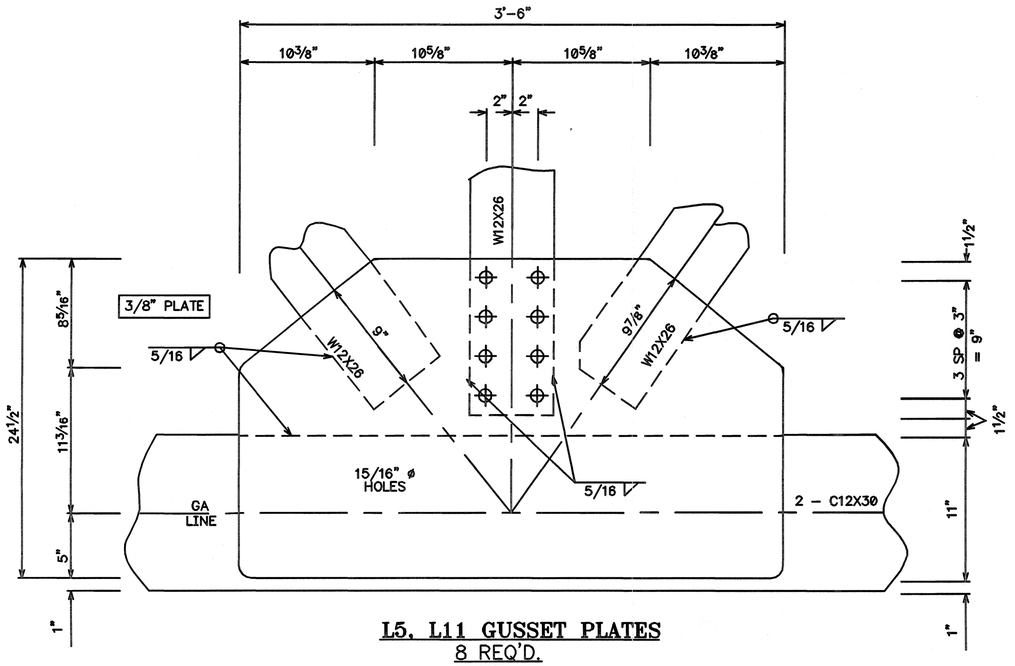
| NO. | DATE | REVISIONS | BY |
|---|---|---|---|
| 1 | 9/26/05 | VDOT REVISIONS | RES |

98'-0" TRUSS BRIDGE 13'-7" RDWY
RT. 645 OVER RAPPAHANNOCK RIVER
VDOT PROJ. NO. 0645-030-6903, SR01
FAUQUIER COUNTY, VIRGINIA

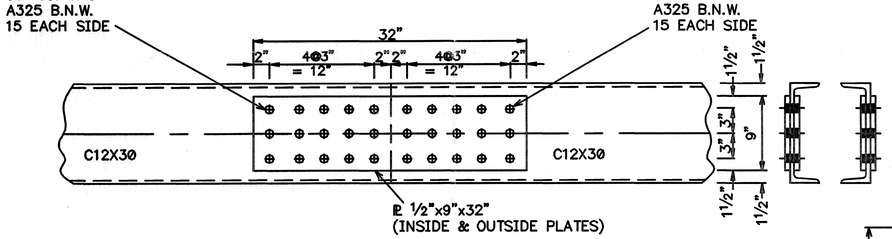
| DESIGN | DRAWN | DATE | DRAWING NO. | SHEET |
|---|---|---|---|---|
| AG | RES | AUG. 30, 2005 | WARRENTON TRUSS | 5 OF 7 |
| CHECK/DATE AG 9/2/05 | FABRICATOR U.S. BRIDGE | | | |



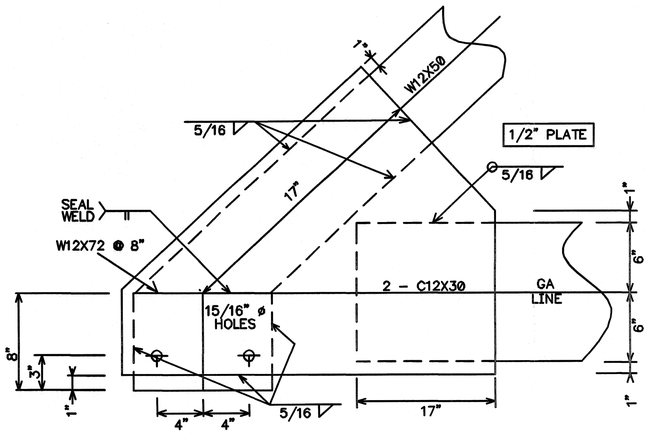

**L3, L13 GUSSET PLATES**
8 REQ'D.



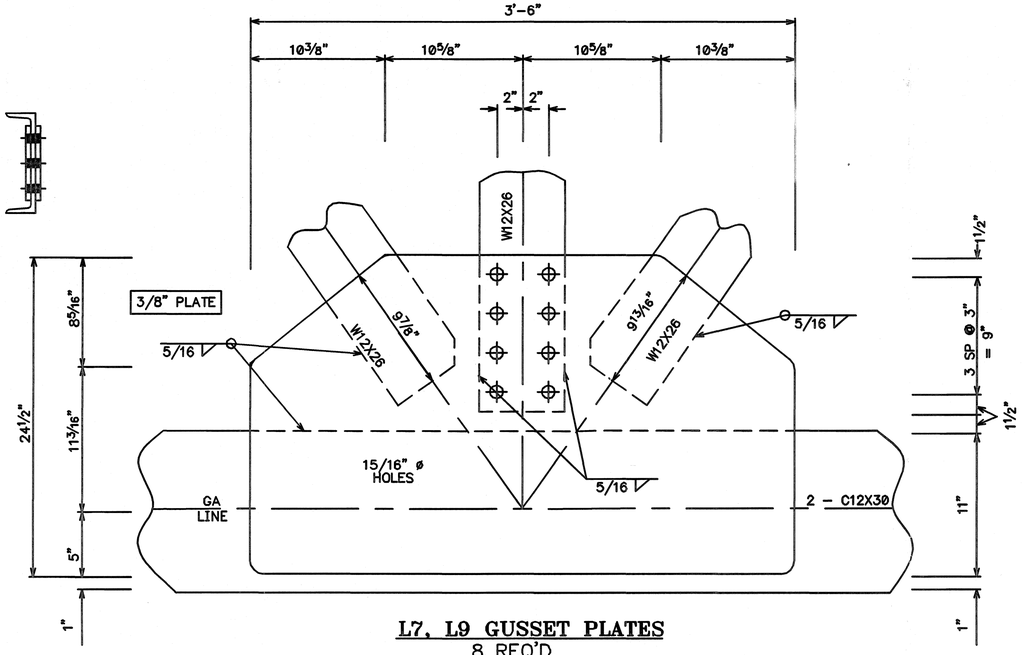

**L5, L11 GUSSET PLATES**
8 REQ'D.




**L5-L7 & L9-L11 SPLICE DETAIL**
4 REQ,D.




**L1 AND L15 GUSSET PLATES- 8 REQ'D.**




**L7, L9 GUSSET PLATES**
8 REQ'D.

VIRGINIA DEPARTMENT OF TRANSPORTATION
REVIEW OF WORKING DRAWINGS

WORKING DRAWINGS HAVE BEEN REVIEWED IN ACCORDANCE WITH SECTION 105.02 OF THE SPECIFICATIONS WITH THE FOLLOWING COMMENTS:
☒ REVIEW COMPLETED.
☐ CORRECT AND RESUBMIT.
☐ REJECTED-SEE REMARKS.
REVIEWED: BRENT SPRINKEL
CULPEPER DIST. BRIDGE ENGR.
BY: PJU
DATE: 11-2-05

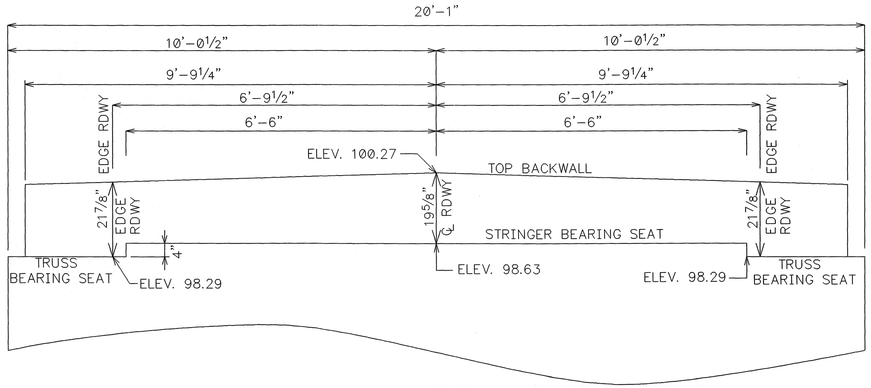
NOTE: DRAWINGS RELATIVE DO NOT SCALE

| NO. | DATE | REVISIONS | BY |
|---|---|---|---|
| 1 | 9/26/05 | VDOT REVISIONS | RES |
| 2 | 10/28/05 | SPLICE DETAIL | RES |
| 3 | 11/2/05 | GUSSET PLATE REV. | RES |

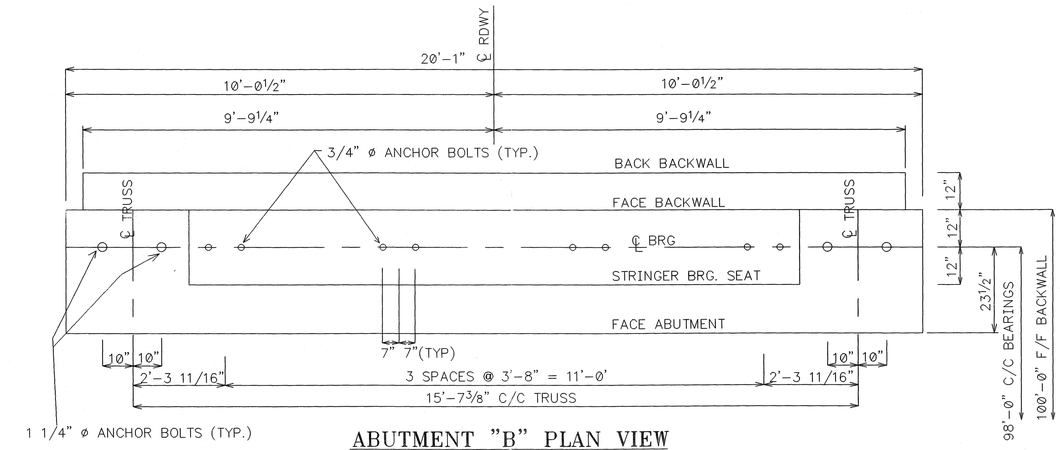
98'-0" TRUSS BRIDGE 13'-7" RDWY
RT. 645 OVER RAPPAHANNOCK RIVER
VDOT PROJ. NO. 0645-030-6903, SR01
FAUQUIER COUNTY, VIRGINIA

| DESIGN | DRAWN | DATE | DRAWING NO. | SHEET |
|---|---|---|---|---|
| AG | RES | AUG. 30, 2005 | WARRENTON TRUSS | 6 OF 7 |
| CHECK/DATE | FABRICATOR | | | |
| AG 9/2/05 | U.S. BRIDGE | | | |

PDF created with pdfFactory trial version www.pdffactory.com

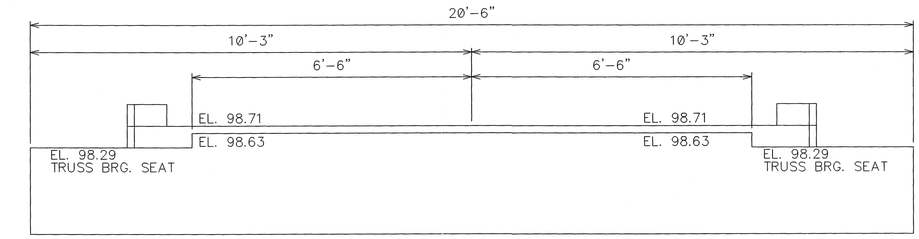



ABUTMENT "B" ELEVATION VIEW

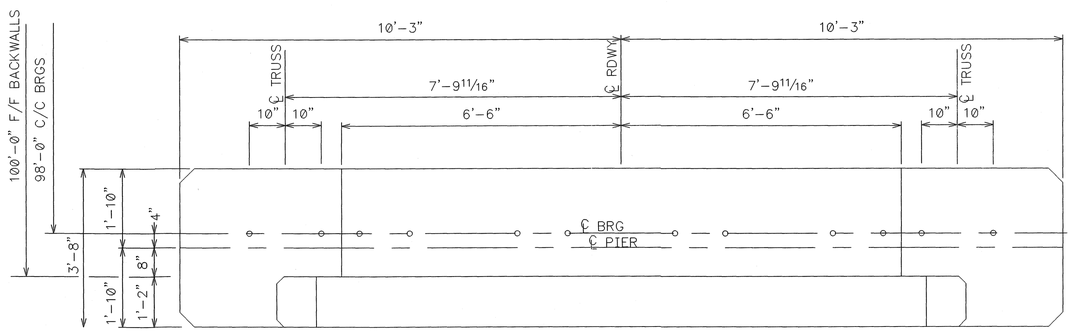



ABUTMENT "B" PLAN VIEW

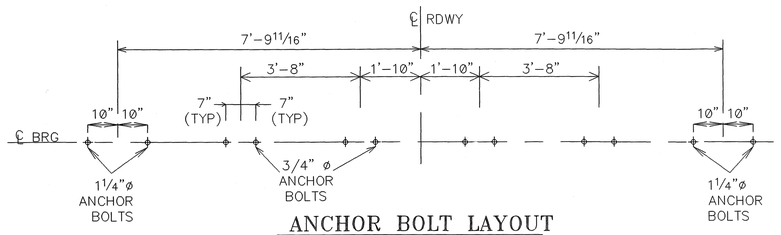
NOTE: WINGWALLS NOT SHOWN FOR CLARITY. PLEASE REFER TO CONTRACT DRAWINGS FOR DETAILS.




PIER 6 ELEVATION VIEW




PIER 6 PLAN VIEW




ANCHOR BOLT LAYOUT

VIRGINIA DEPARTMENT OF TRANSPORTATION
REVIEW OF WORKING DRAWINGS

WORKING DRAWINGS HAVE BEEN REVIEWED IN ACCORDANCE WITH SECTION 105.02 OF THE SPECIFICATIONS WITH THE FOLLOWING COMMENTS:

☒ REVIEW COMPLETED.
☐ CORRECT AND RESUBMIT.
☐ REJECTED-SEE REMARKS.

BY: PJH
DATE: 10-11-05

REVIEWED: BRENT SPRINKEL
CULPEPER DIST. BRIDGE ENGR.

| NO. | DATE | REVISIONS | BY |
|---|---|---|---|
| 1 | 9/26/05 | VDOT REVISIONS | RES |

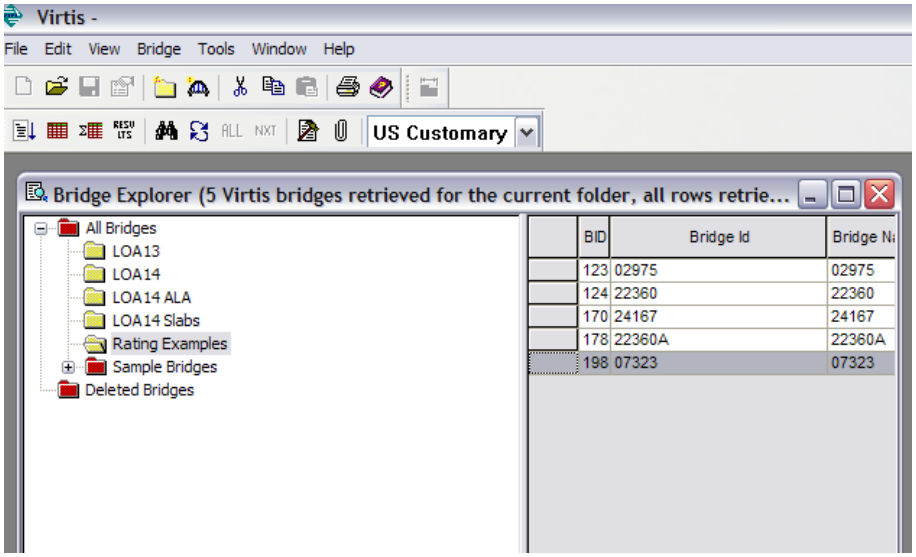
98'-0" TRUSS BRIDGE 13'-7" RDWY
RT. 645 OVER RAPPAHANNOCK RIVER
VDOT PROJ. NO. 0645-030-6903, SR01
FAUQUIER COUNTY, VIRGINIA

| DESIGN | DRAWN | DATE | DRAWING NO. | SHEET |
|---|---|---|---|---|
| AG | RES | AUG. 30, 2005 | WARRENTON TRUSS | 7 OF 116 7 |
| CHECK/DATE AG 9/2/05 | FABRICATOR U.S. BRIDGE | | | |

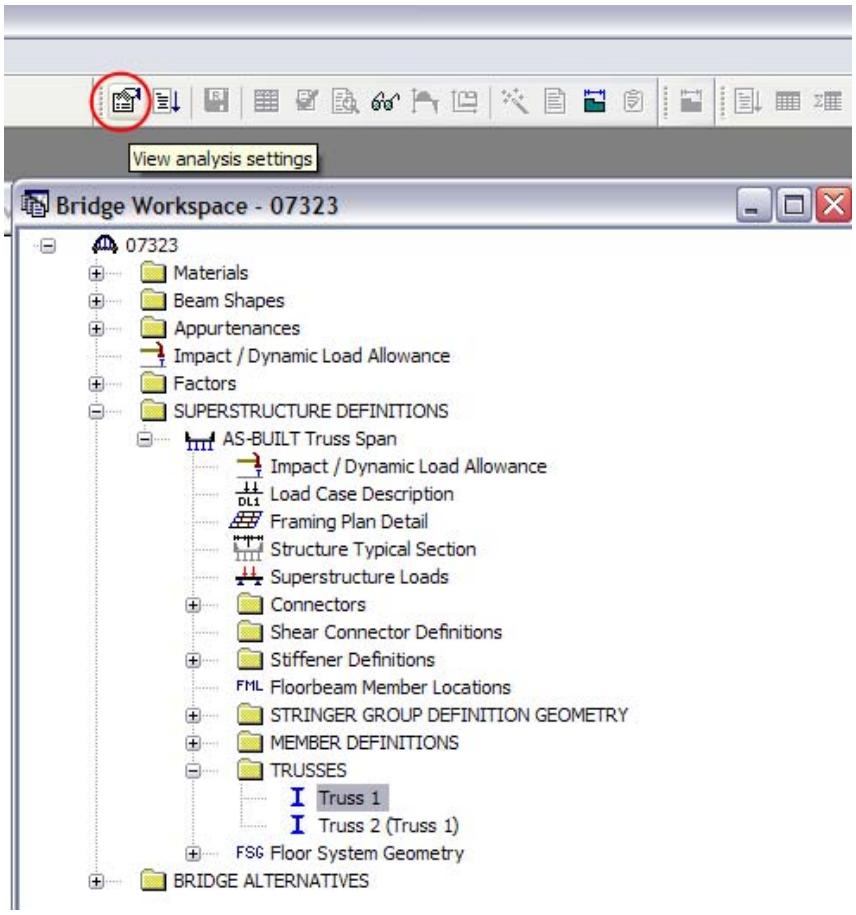
NOTE: DRAWINGS RELATIVE DO NOT SCALE

# APPENDIX B: PANEL POINT LOAD CALCULATION

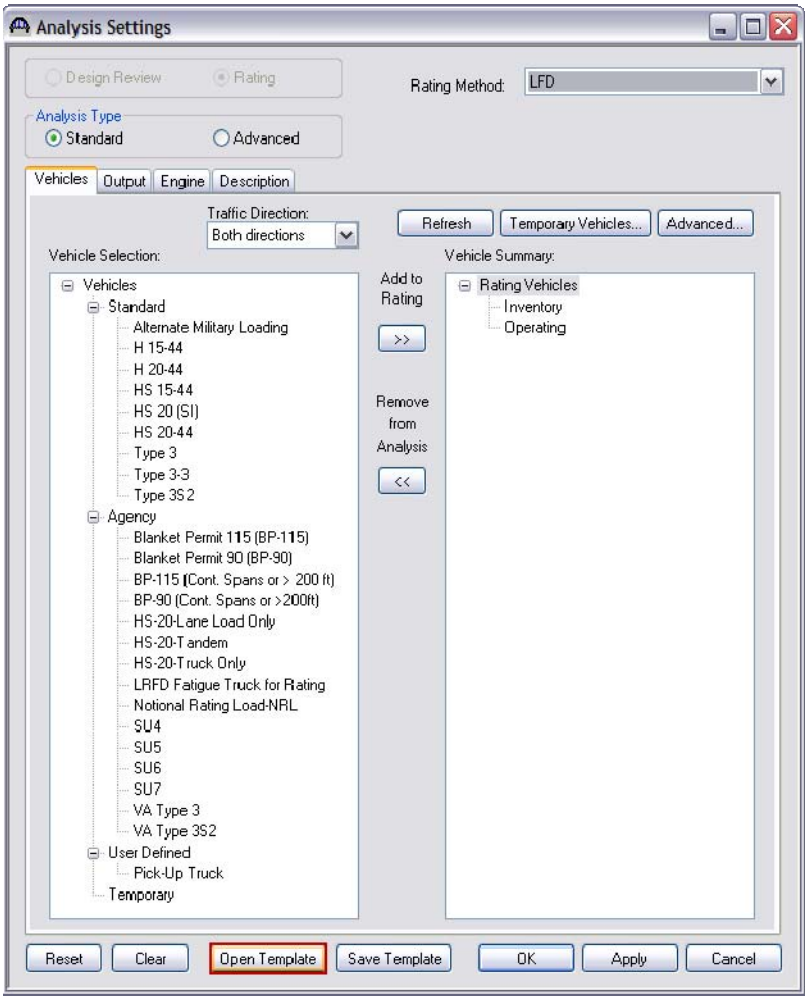
This process is required because floorbeams are not located at the abutments. The stringers rest directly on the abutments rather than a floorbeam. However, a floorbeam must be placed at each panel point for Virtis to analyze the truss. Therefore, an upward force was placed at the end supports since ficticious floorbeams were placed at these loctions.



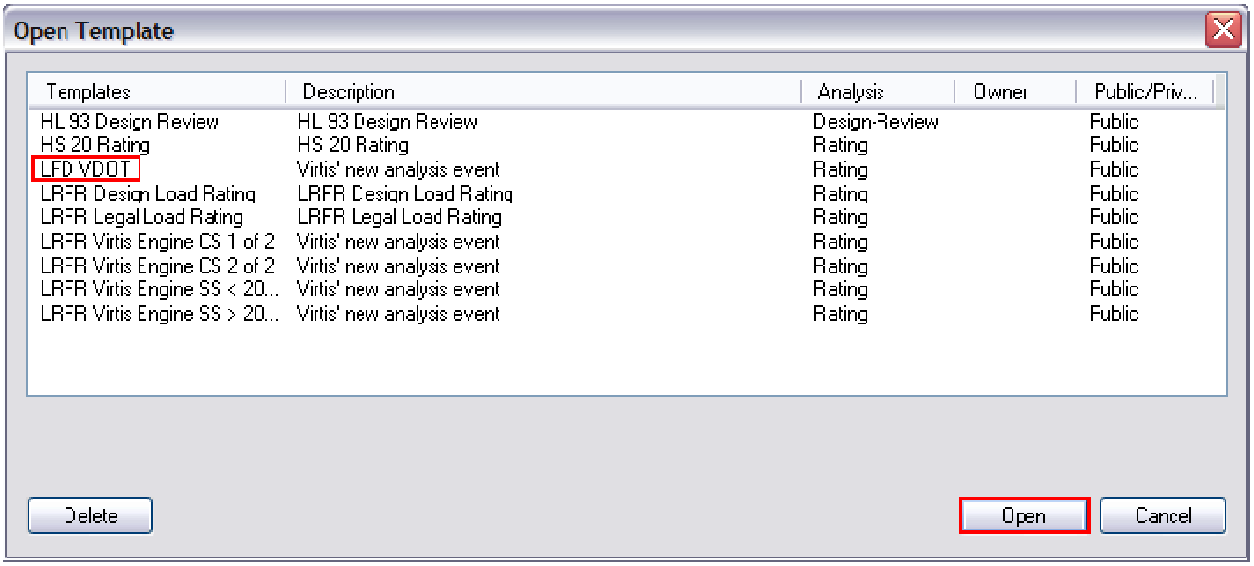

To calculate the panel point load at the locations of the fictitious floorbeams, first open the bridge in the **Bridge Explorer** window.



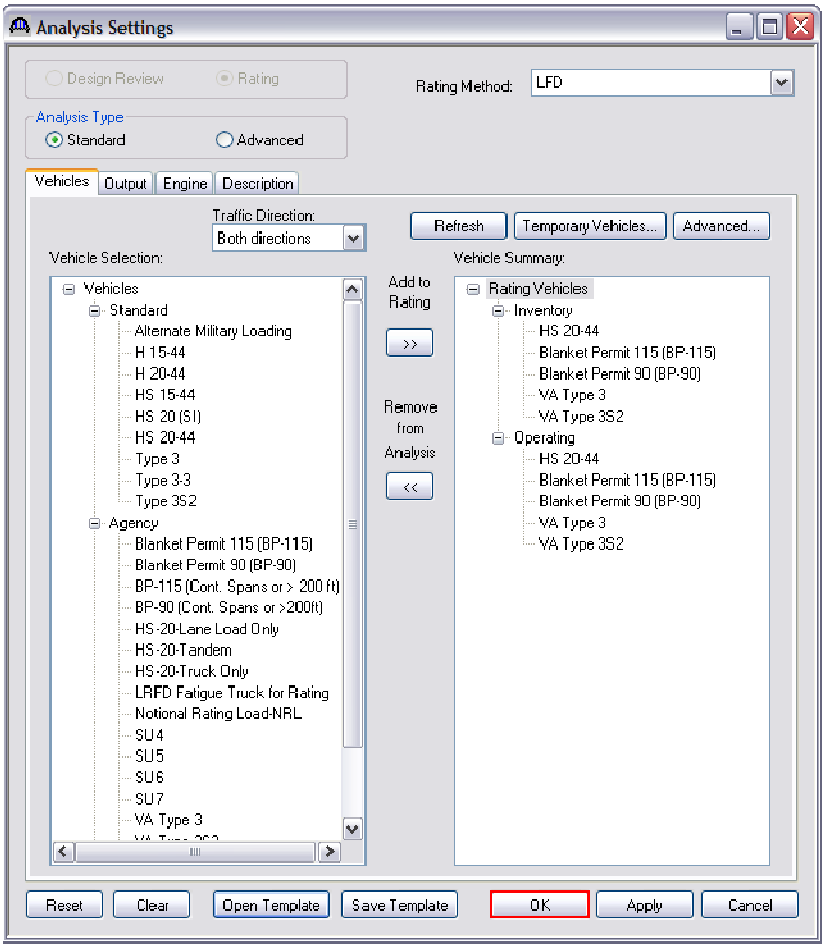

Left click **View analysis settings**.



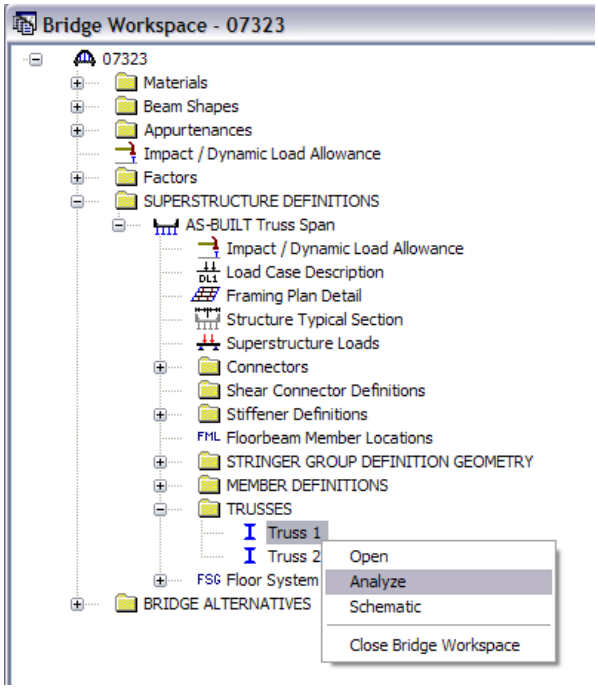

Left click the **Open Template** button.



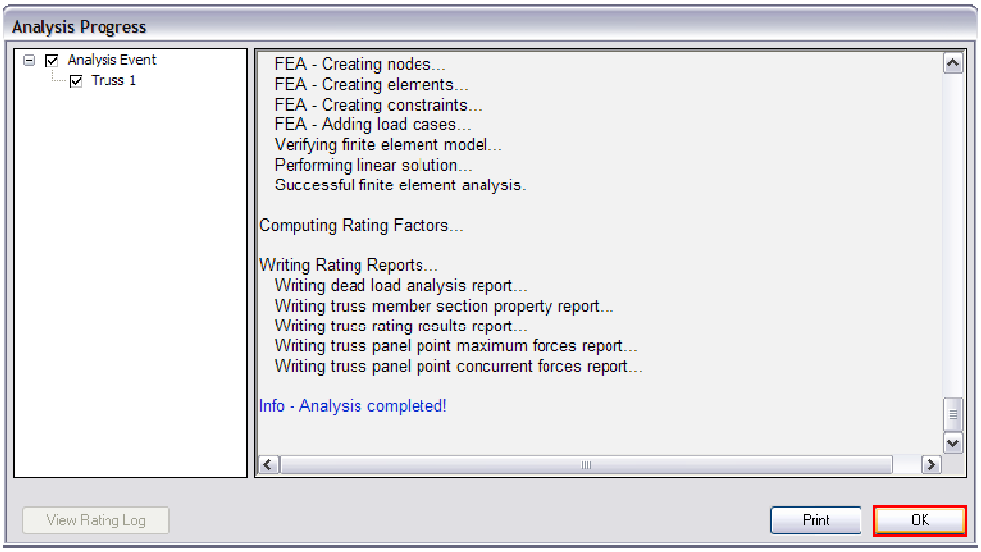

Left click the **LFD VDOT** template and left click the **Open** button.



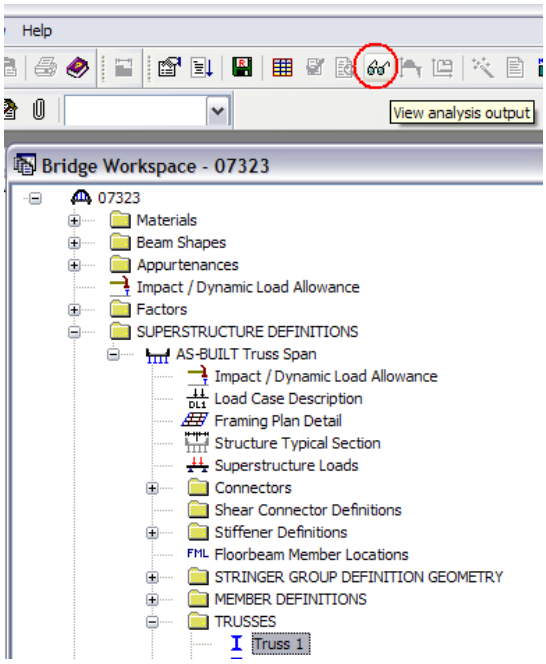

Left click the **OK** button to accept and close.



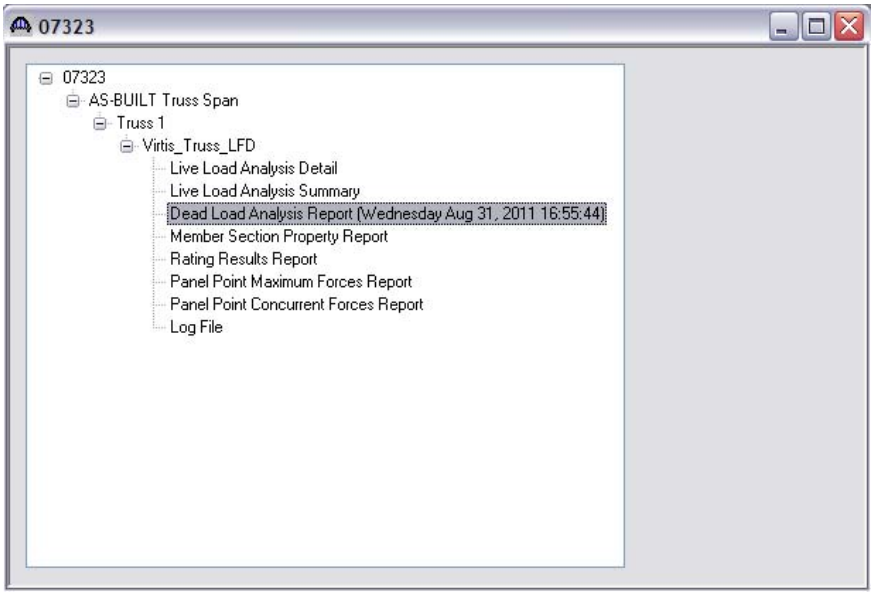

Right click **Truss 1** and select **Analyze**.




Let the analysis complete and left click **OK** to close.




Highlight **Truss 1** and left click the **View analysis output** icon.




Double click **Dead Load Analysis Report**.

An internet explorer window will open. Scroll down to the **Deck DC**, **Superstructure Stringer Units DC** and **Superstructure Floorbeam DC** load cases.

## Load Case: Deck DC
## Load ID: 1

### Nodal Loads

| Node | X Force (kip ) | Y Force (kip ) | Z Force (kip ) | X Moment (kip-ft ) | Y Moment (kip-ft ) | Z Moment (kip-ft ) |
|---|---|---|---|---|---|---|
| 1 | 0.000 | -3.066 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2 | 0.000 | -6.133 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3 | 0.000 | -6.133 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4 | 0.000 | -6.133 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5 | 0.000 | -6.133 | 0.000 | 0.000 | 0.000 | 0.000 |
| 6 | 0.000 | -6.133 | 0.000 | 0.000 | 0.000 | 0.000 |
| 7 | 0.000 | -6.133 | 0.000 | 0.000 | 0.000 | 0.000 |
| 8 | 0.000 | -3.066 | 0.000 | 0.000 | 0.000 | 0.000 |

## Load Case: Superstructure Stringer Units DC
## Load ID: 2

### Nodal Loads

| Node | X Force (kip ) | Y Force (kip ) | Z Force (kip ) | X Moment (kip-ft ) | Y Moment (kip-ft ) | Z Moment (kip-ft ) |
|---|---|---|---|---|---|---|
| 1 | 0.000 | -0.420 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2 | 0.000 | -0.840 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3 | 0.000 | -0.840 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4 | 0.000 | -0.840 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5 | 0.000 | -0.840 | 0.000 | 0.000 | 0.000 | 0.000 |
| 6 | 0.000 | -0.840 | 0.000 | 0.000 | 0.000 | 0.000 |
| 7 | 0.000 | -0.840 | 0.000 | 0.000 | 0.000 | 0.000 |
| 8 | 0.000 | -0.420 | 0.000 | 0.000 | 0.000 | 0.000 |

## Load Case: Superstructure Floorbeam DC
## Load ID: 3

### Nodal Loads

| Node | X Force (kip ) | Y Force (kip ) | Z Force (kip ) | X Moment (kip-ft ) | Y Moment (kip-ft ) | Z Moment (kip-ft ) |
|---|---|---|---|---|---|---|
| 1 | 0.000 | -0.429 | 0.000 | 0.000 | 0.000 | 0.000 |
| 2 | 0.000 | -0.429 | 0.000 | 0.000 | 0.000 | 0.000 |
| 3 | 0.000 | -0.429 | 0.000 | 0.000 | 0.000 | 0.000 |
| 4 | 0.000 | -0.429 | 0.000 | 0.000 | 0.000 | 0.000 |
| 5 | 0.000 | -0.429 | 0.000 | 0.000 | 0.000 | 0.000 |
| 6 | 0.000 | -0.429 | 0.000 | 0.000 | 0.000 | 0.000 |
| 7 | 0.000 | -0.429 | 0.000 | 0.000 | 0.000 | 0.000 |
| 8 | 0.000 | -0.429 | 0.000 | 0.000 | 0.000 | 0.000 |

**Force at L0, L14**

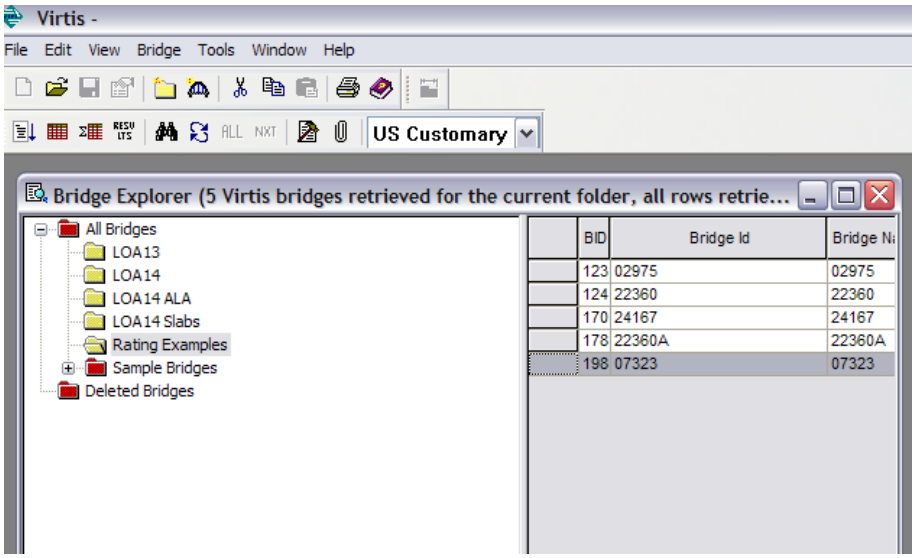
| | | |
|---|---|---|
| ID1 - Deck | 3.066 | kips |
| ID2 - Stringer | 0.420 | kips |
| ID3 - Floorbeam | 0.429 | kips |

**Upward Force = 3.92 kips (reaction at 1 support for 1 truss line)**

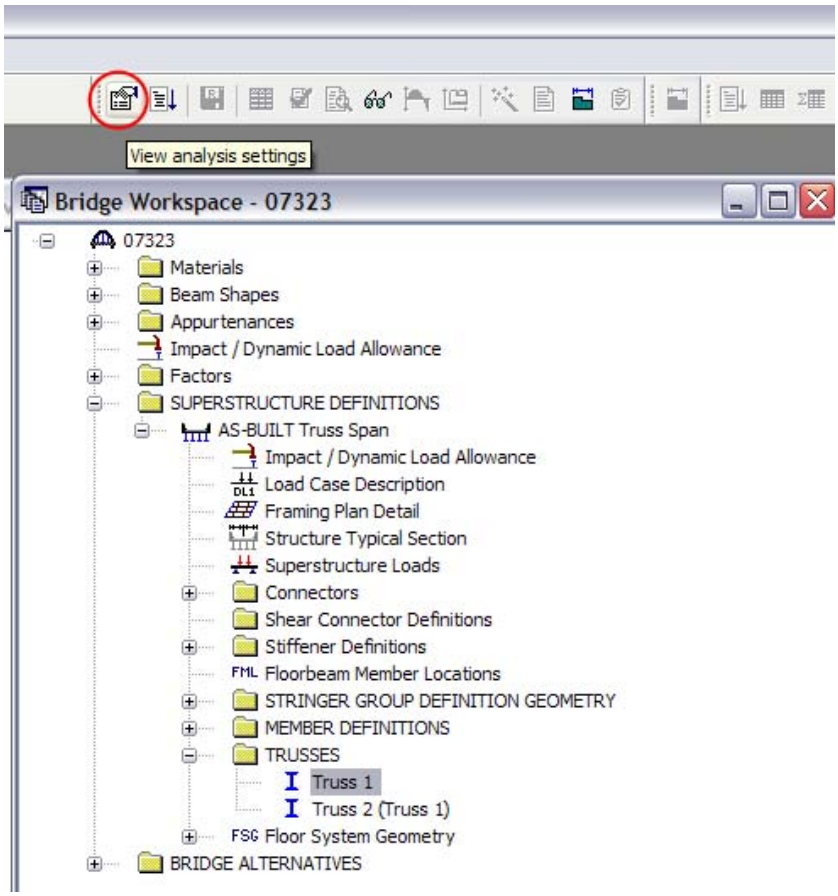
The upward force will be entered into the Panel Point Load Command on the Truss Input Command window as shown on page 53.

# APPENDIX C: ADDITIONAL SELF LOAD CALCULATION

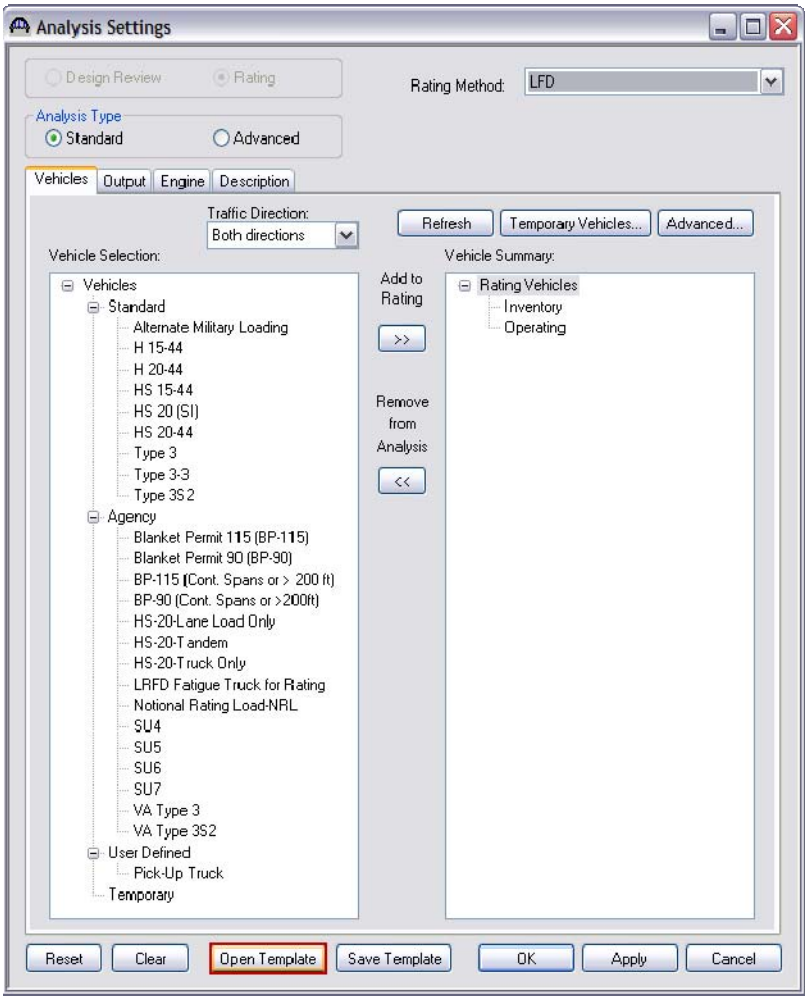
The purpose of this process is to calculate the additional self load due to bolts, splices, gusset plates, and all other truss components that are not specifically modeled within Virtis. The user will analyze the bridge once without an additional load. The difference between the total dead load end support reaction specified on the plans and the reaction computed in Virtis is the missing load which will then be applied as the additional self load.



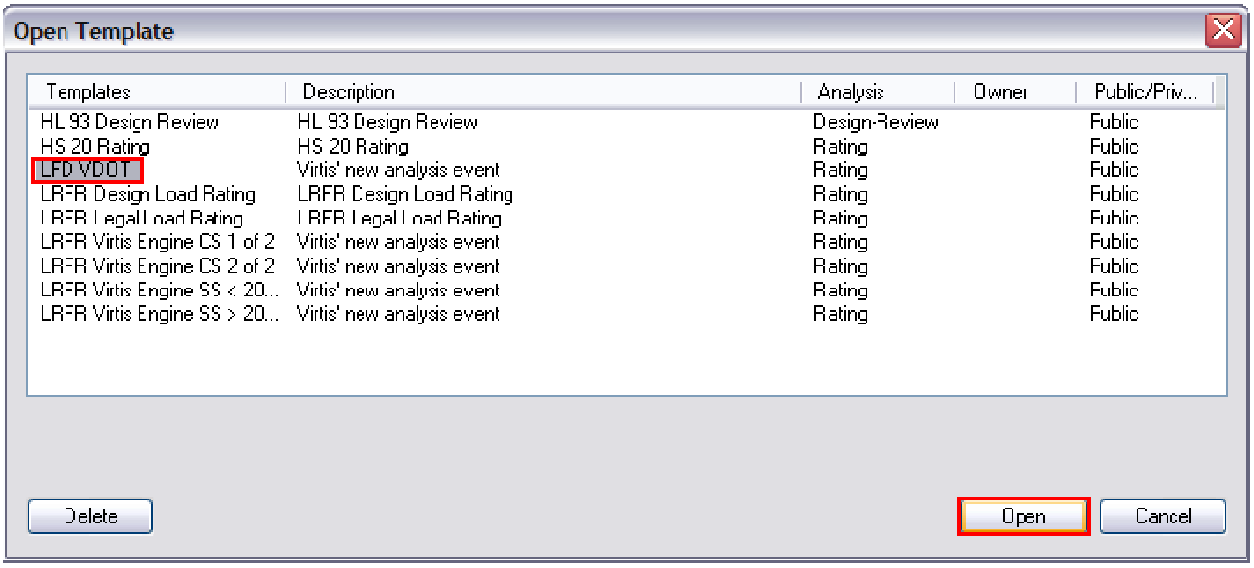

To calculate the additional self load of the truss, first open the bridge in the **Bridge Explorer** window.



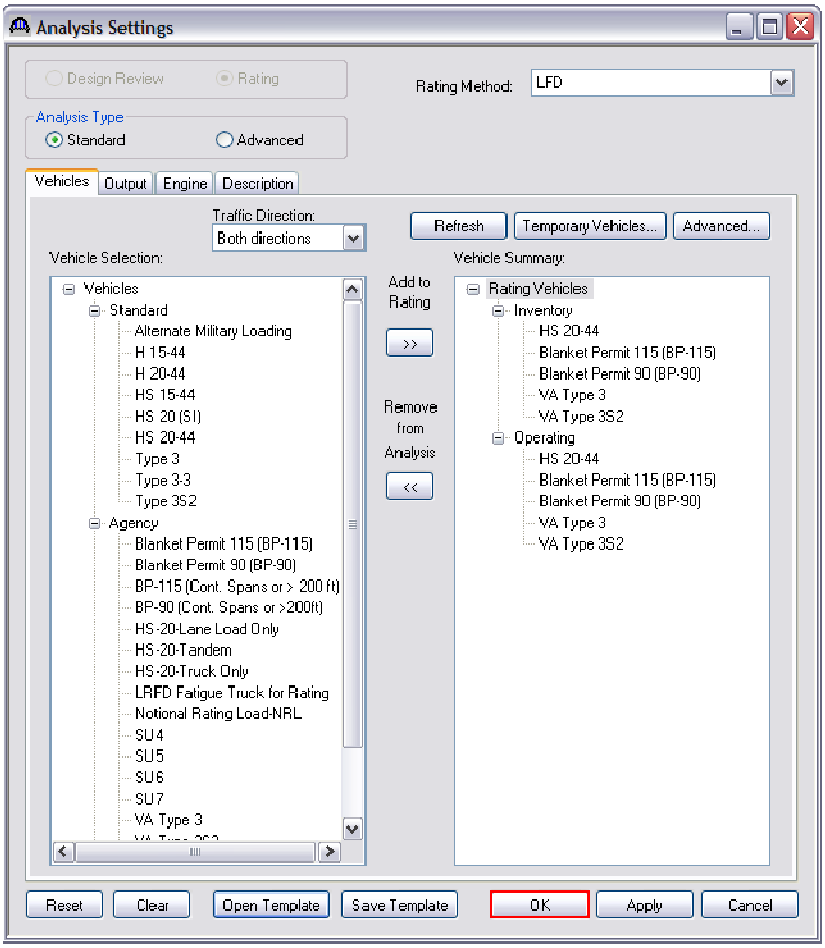

Left click **View analysis settings**.



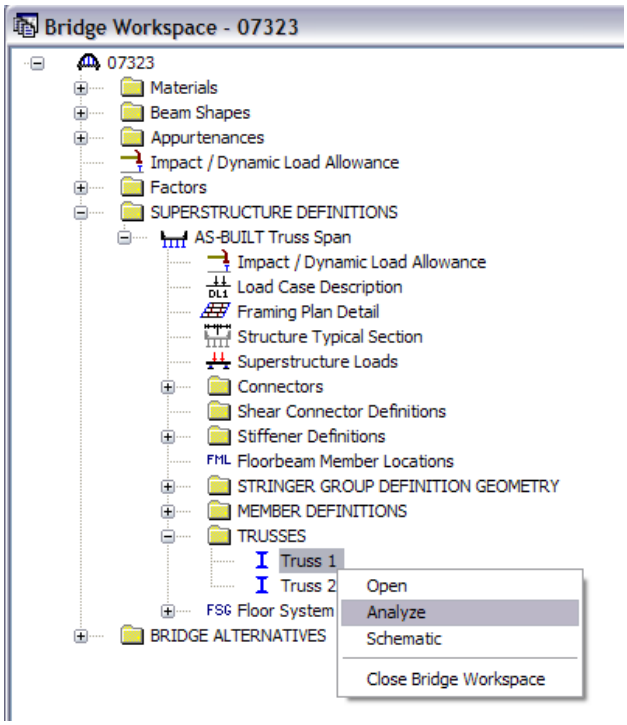

Left click the **Open Template** button.



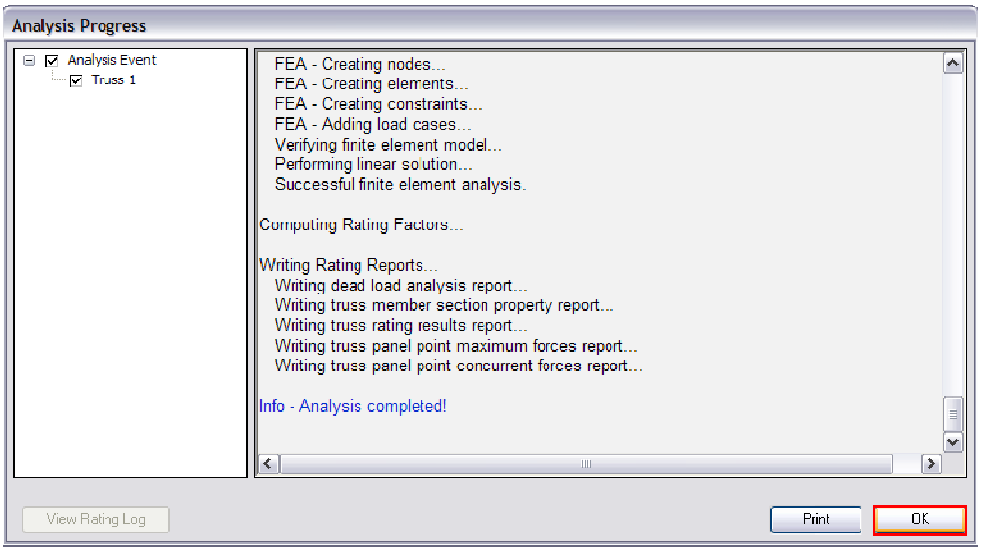

Left click the **LFD VDOT** template and then left click the **Open** button.



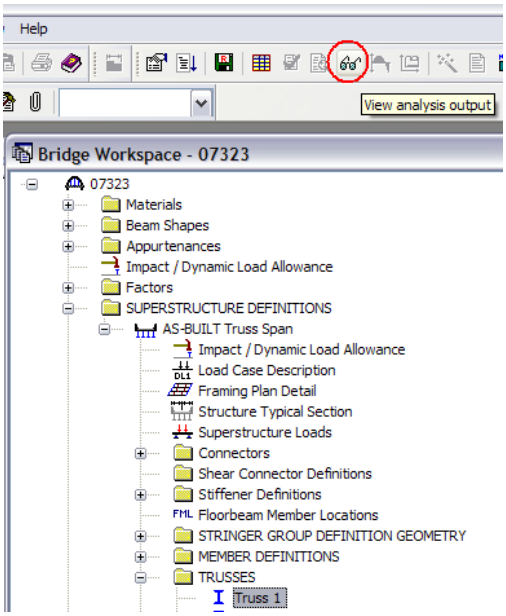

Left click the **OK** button to accept and close.



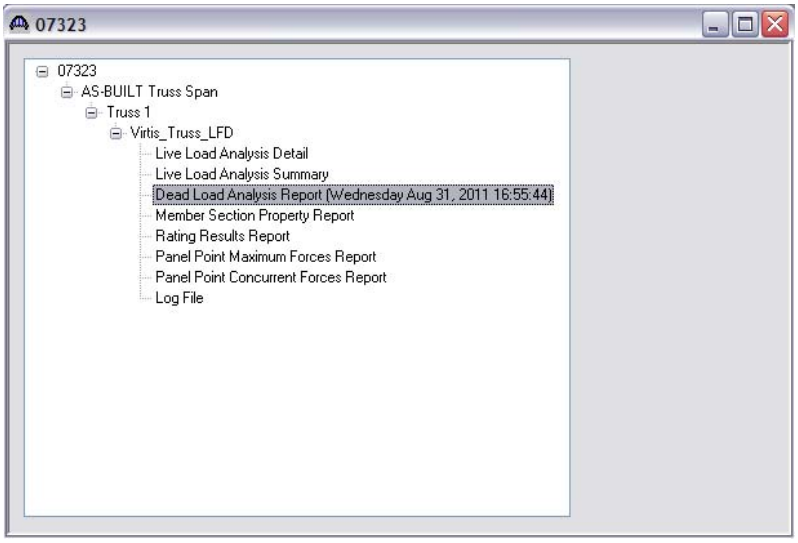

Right click **Truss 1** and select **Analyze**.




Let the analysis complete and left click **OK** to close.




Highlight **Truss 1** and left click the **View Analysis Output** icon.




Double click **Dead Load Analysis Report**.

An internet explorer window will open. Scroll down to the support reactions for **Deck DC**, **Stringer Units DC**, **Floorbeam DC**, and **Self Weight DC**.

# Support Reactions

**Load Case: Deck DC**
**Load ID: 1**

| Node | X Force (kip) | Y Force (kip) | Z Force (kip) |
|---|---|---|---|
| 1 | 0.000 | 21.465 | 0.000 |

**Load Case: Superstructure Stringer Units DC**
**Load ID: 2**

| Node | X Force (kip) | Y Force (kip) | Z Force (kip) |
|---|---|---|---|
| 1 | 0.000 | 2.940 | 0.000 |

**Load Case: Superstructure Floorbeam DC**
**Load ID: 3**

| Node | X Force (kip) | Y Force (kip) | Z Force (kip) |
|---|---|---|---|
| 1 | 0.000 | 1.718 | 0.000 |

**Load Case: SelfWeight DC**
**Load ID: 4**

| Node | X Force (kip) | Y Force (kip) | Z Force (kip) |
|---|---|---|---|
| 1 | 0.000 | 8.020 | 0.000 |

**Calculate Misc Truss Wt using Total Wt from Design Plans**

| | | | |
|---|---|---|---|
| | 191200 | lbs | *From sheet 2 of 8 of plan 286-07 |
| | **191.20** | **kips** | |

Since a fictitious floorbeam was placed at L0 and L14, an upward force must be placed at these locations.

Force at L0

| | | |
|---|---|---|
| ID1 - Deck | 3.071 | kips |
| ID2 - Stringer | 0.420 | kips |
| ID3 - Floorbeam | 0.429 | kips |

| | | |
|---|---|---|
| **Upward Force =** | **3.92** | **kips (reaction at 1 support for 1 truss line)** |

| | | |
|---|---|---|
| Total = | 15.68 | kips (two trusses, two supports) |

| | | |
|---|---|---|
| ID1 - Deck | 21.465 | kips (reaction at 1 support for 1 truss line) |
| ID2 - Stringer | 2.940 | kips (reaction at 1 support for 1 truss line) |
| ID3 - Floorbeam | 1.718 | kips (reaction at 1 support for 1 truss line) |
| ID4 - Self Weight | 8.020 | kips (reaction at 1 support for 1 truss line) |
| Total = | 34.14 | kips (reaction at 1 support for 1 truss line) |
| Total = | 136.57 | kips (two trusses, two supports) |
| Total = 136.57 - 15.68= | 120.89 | kip |

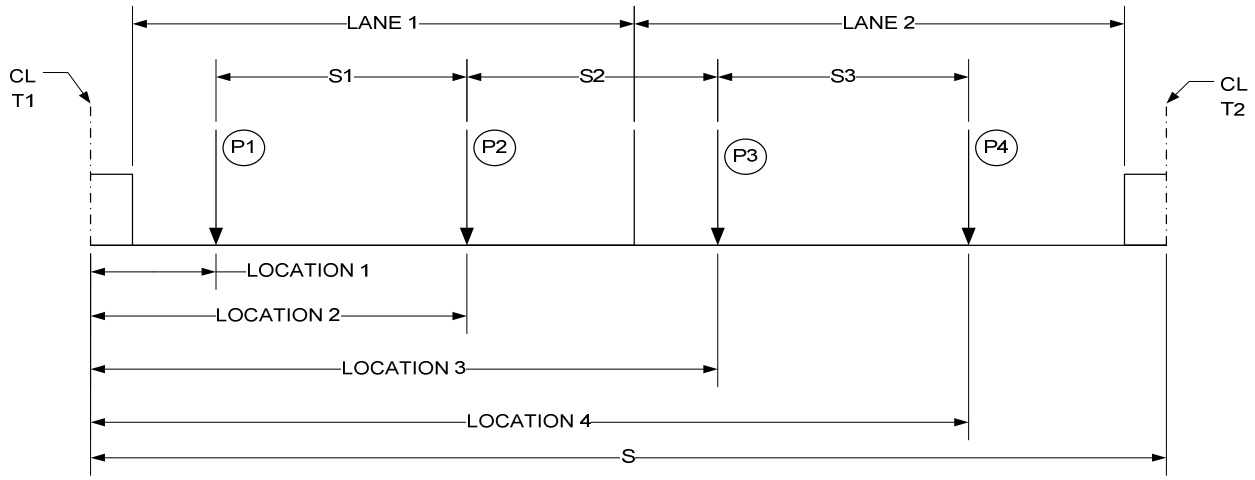
| | | |
|---|---|---|
| Total = 191.20 - 120.89= | 70.31 | kips |
| Distributed to each truss = | 35.15 | kips |
| Length of Truss = | 98.00 | ft |
| **Additional Self Load =** | **0.3590** | **k/ft** |

The additional self load will be entered into the Additional Self Load Command in the Truss Input Command window as shown on page 54.

# APPENDIX D: LIVE LOAD DISTRIBUTION FACTOR CALCULATION

## Truss Distribution Factors Calculation

### Distribution Factor for Force




| | | | |
|---|---|---|---|
| Spacing = S = | 15.61 | ft | |
| P1 Location = | 3.02 | ft | *(2 ft from face of barrier)* |
| Spacing 1 = S1 = | 6.00 | ft | |
| P2 Location = | 9.02 | ft | |
| Spacing 2 = S2 = | 0.00 | ft | *(lanes are less than 12ft, location of P3 will be 2ft from edge of lane 1)* |
| P3 Location = | N/A | ft | |
| Spacing 3 = S3 = | 0.00 | ft | |
| P4 Location = | N/A | ft | |

| | | | |
|---|---|---|---|
| Reduction in Load Intensity = | 1 | *AASHTO LFD 3.12.1* | |
| 1 lane DF = | 1.229 | WHEELS | |
| 1 lane DF = | **0.615** | AXLES | ****Virtis Input* |

| | | | |
|---|---|---|---|
| Reduction in Load Intensity = | 1 | *AASHTO LFD 3.12.1* | |
| 2 lane DF = | 1.229 | WHEELS | |
| 2 lane DF = | **0.615** | AXLES | ****Virtis Input* |

*AASHTO Standard Specifications for Highway Bridges, 1996, Sixteenth Edition, including the 1997 and 1998 Interim Specifications Section 3.6.3*

Fractional parts of design lanes shall not be used, but roadway widths from 20 to 24 feet shall have two design lanes each equal to one-half the roadway width.

**Distribution Factor for Deflection**

*Single Lane*

| | | |
|---|---|---|
| Number of Lanes = | 1 | lane |
| Lane Width = | 12 | feet |
| Number of Trusses = | 2 | Trusses |

| | | |
|---|---|---|
| DF for deflection = ( 1 lane ) / ( 2 trusses ) = | **0.500** | Lanes |

*Multi-Lane*

Number of Lanes = ( Curb to Curb Width / Lane Width ) (Round down)

Deflection Factor = ( ( # Lanes ) / # Trusses ) * Load Intensity Reduction

| Curb to Curb ft | Number of Lanes ------- | Load Intensity Reduction ------- | Deflection Factor Lanes |
|---|---|---|---|
| 13.25 | 1 | 100% | **0.500** |

*Note:*
*Load Intensity Reduction detemined from AASHTO Standard Specifications for Highway Bridges, 16th Ed, 3.12.1*

# APPENDIX E: RATING FACTOR AND TONNAGE CALCULATIONS FOR TRUSS MEMBERS

## Overview

The Purpose of this Mathcad sheet is to calculate rating factors and tonnages for vehicle configurations in the Virginia Department of Transportation Structure and Bridge Division's Instructional and Informational Memorandum IIM-S&B-27.6.

This sheet does not provide any analysis calculations, but only provides calculations for rating factors and load ratings using output from Virtis 6.2 using the BRASS LFD engine for steel truss members.

## References

AASHTO 2011, *The Manual for Bridge Evaluation*, Second Edition

AASHTO 1996 with 1997 and 1998 Interim Revisions, Standard *Specifications for Highway Bridges*, Sixteenth Edition

VDOT Structure and Bridge Division Instructional and Informational Memorandum 27.6, January 7, 2008 (IIM-S&B-27.6)

## Notes

1. Input cells are highlighted in yellow.
2. Only LFD analysis modules can be used to analyze trusses in Virtis 6.2.

## VDOT Vehicle Configuration Tonnages

| *Design Vehicles* | *Legal Vehicles* | *Permit Vehicles* |
|---|---|---|
| HS20 := 36·ton | VAType3 := 27·ton | BP90 := 45·ton |
| | VAType3S2 := 40·ton | BP115 := 57.5·ton |

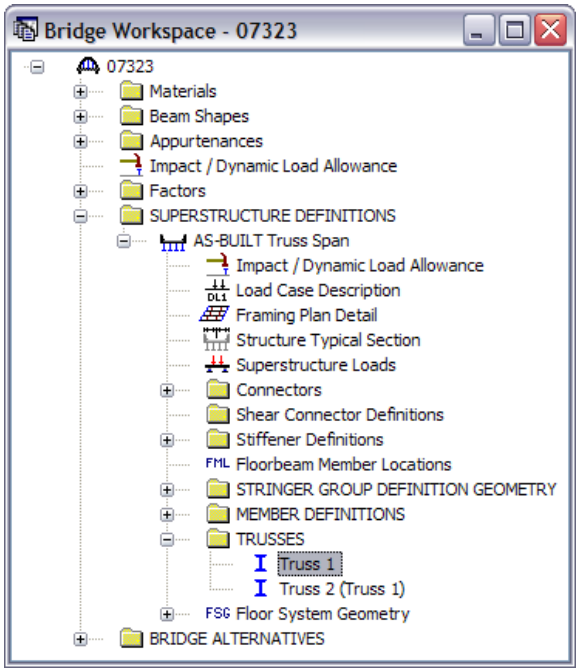
## Truss Member of Interest

U5U6

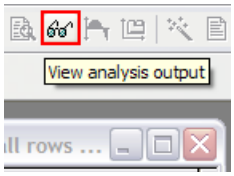
Note: For this example, the controlling member is the member of interest.

## Locating Rating Information

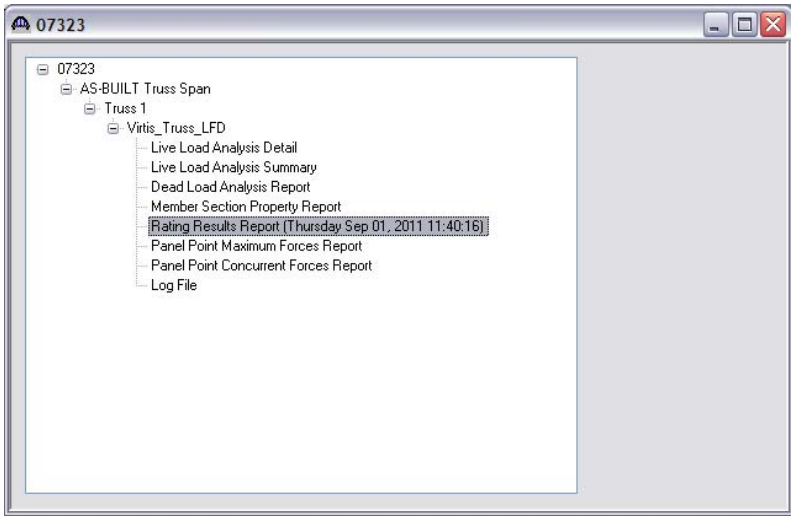
1. After analyzing the desired truss, highlight **TRUSS 1**.




2. Left click the **View Analysis Output** icon.




3. Double click **Rating Results Report**.



4. An Internet Explorer window will appear. Scroll down to the **Detailed Truss Member Rating Results**. See screen shots below for dead load forces, live load forces, impact factors, capacities, and live load distribution factors.

**Dead Load Force**

$DL := 127.44 \cdot kip$

Notes:

1. The dead load force will be the same for each vehicle. Therefore, record the DL force from any of the truck results displayed.
2. Negative values are used for compression and positive values are used for tension in the Virtis output. However, the user should enter an absolute values into the Mathcad sheet.

| Member | Truss Element | DL Force (kip) | LL Force | | | | Capacity | | One Lane LLDF | Multi Lane LLDF | Inv RF | Opr RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Comp. (kip) | IF | Tens. (kip) | IF | Comp. (kip) | Tens. (kip) | | | | |
| U5U6 | Upper-Chord | -127.44 | -159.45 | 1.22 | | | -596.47 | | 0.61 | | 1.65 | 2.76 |
| | | -127.44 | -159.45 | 1.22 | | | -596.47 | | | 0.61 | 1.65 | 2.76 |
| | | -127.44 | -159.45 | | | | -596.47 | | 0.61 | | 2.02 | 3.38 |
| | | -127.44 | -159.45 | | | | -596.47 | | | 0.61 | 2.02 | 3.38 |

## Live Load Force

Notes:

1. Negative values are used for compression and positive values are used for tension in the Virtis output. However, the user should enter an absolute values into the Mathcad sheet.

*Design Vehicles*

$HS20_{LL} := 147.20 \cdot kip$

*Legal Vehicles*

$VAType3_{LL} := 108.57 \cdot kip$

$VAType3S2_{LL} := 127.51 \cdot kip$

*Permit Vehicles*

$BP90_{LL} := 159.33 \cdot kip$

$BP115_{LL} := 159.45 \cdot kip$

### Live Load: HS 20-44 (Design Truck)

| Member | Truss Element | DL Force (kip) | LL Force Comp. (kip) | IF | Tens. (kip) | IF | Capacity Comp. (kip) | Tens. (kip) | One Lane LLDF | Multi Lane LLDF | Inv RF | Opr RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U5U6 | Upper-Chord | -127.44 | -147.20 | 1.22 | | | -596.47 | | 0.61 | | 1.79 | 2.99 |
| | | -127.44 | -147.20 | 1.22 | | | -596.47 | | | 0.61 | 1.79 | 2.99 |

### Live Load: VA Type 3 (Design Truck)

| Member | Truss Element | DL Force (kip) | LL Force Comp. (kip) | IF | Tens. (kip) | IF | Capacity Comp. (kip) | Tens. (kip) | One Lane LLDF | Multi Lane LLDF | Inv RF | Opr RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U5U6 | Upper-Chord | -127.44 | -108.57 | 1.22 | | | -596.47 | | 0.61 | | 2.43 | 4.05 |
| | | -127.44 | -108.57 | 1.22 | | | -596.47 | | | 0.61 | 2.43 | 4.05 |

### Live Load: VA Type 3S2 (Design Truck)

| Member | Truss Element | DL Force (kip) | LL Force Comp. (kip) | IF | Tens. (kip) | IF | Capacity Comp. (kip) | Tens. (kip) | One Lane LLDF | Multi Lane LLDF | Inv RF | Opr RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U5U6 | Upper-Chord | -127.44 | -127.51 | 1.22 | | | -596.47 | | 0.61 | | 2.07 | 3.45 |
| | | -127.44 | -127.51 | 1.22 | | | -596.47 | | | 0.61 | 2.07 | 3.45 |

### Live Load: Blanket Permit 90 (BP-90) (Design Truck)

| Member | Truss Element | DL Force (kip) | LL Force Comp. (kip) | IF | Tens. (kip) | IF | Capacity Comp. (kip) | Tens. (kip) | One Lane LLDF | Multi Lane LLDF | Inv RF | Opr RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U5U6 | Upper-Chord | -127.44 | -159.33 | 1.22 | | | -596.47 | | 0.61 | | 1.65 | 2.76 |
| | | -127.44 | -159.33 | 1.22 | | | -596.47 | | | 0.61 | 1.65 | 2.76 |

### Live Load: Blanket Permit 115 (BP-115) (Design Truck)

| Member | Truss Element | DL Force (kip) | LL Force Comp. (kip) | IF | Tens. (kip) | IF | Capacity Comp. (kip) | Tens. (kip) | One Lane LLDF | Multi Lane LLDF | Inv RF | Opr RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U5U6 | Upper-Chord | -127.44 | -159.45 | 1.22 | | | -596.47 | | 0.61 | | 1.65 | 2.76 |
| | | -127.44 | -159.45 | 1.22 | | | -596.47 | | | 0.61 | 1.65 | 2.76 |

## Impact Factor

$IM := 1.22$

Note: The impact factor will be the same for each vehicle since this value is based upon the span length.

| Member | Truss Element | DL Force (kip) | LL Force Comp. (kip) | IF | Tens. (kip) | IF | Capacity Comp. (kip) | Tens. (kip) | One Lane LLDF | Multi Lane LLDF | Inv RF | Opr RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| U5U6 | Upper-Chord | -127.44 | -159.45 | 1.22 | | | -596.47 | | 0.61 | | 1.65 | 2.76 |
| | | -127.44 | -159.45 | 1.22 | | | -596.47 | | | 0.61 | 1.65 | 2.76 |
| | | -127.44 | -159.45 | | | | -596.47 | | 0.61 | | 2.02 | 3.38 |
| | | -127.44 | -159.45 | | | | -596.47 | | | 0.61 | 2.02 | 3.38 |

## Capacity

$C_{Member} := 596.47 \cdot kip$

Notes:

1. The capacity will be the same for each vehicle.
2. Negative values are used for compression and positive values are used for tension in the Virtis output. However, the user should enter an absolute values into the Mathcad sheet.

| Member | Truss Element | DL Force (kip) | LL Force | | | | Capacity | | One Lane LLDF | Multi Lane LLDF | Inv RF | Opr RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Comp. (kip) | IF | Tens. (kip) | IF | Comp. (kip) | Tens. (kip) | | | | |
| U5U6 | Upper-Chord | -127.44 | -159.45 | 1.22 | | | -596.47 | | 0.61 | | 1.65 | 2.76 |
| | | -127.44 | -159.45 | 1.22 | | | -596.47 | | | 0.61 | 1.65 | 2.76 |
| | | -127.44 | -159.45 | | | | -596.47 | | 0.61 | | 2.02 | 3.38 |
| | | -127.44 | -159.45 | | | | -596.47 | | | 0.61 | 2.02 | 3.38 |

## LFD Live Load Distribution Factors

$DF := 0.61$

Note: The live load distribution factor will be the same for each vehicle. User should use the largest value between One Lane and Multi-Lane.

| Member | Truss Element | DL Force (kip) | LL Force | | | | Capacity | | One Lane LLDF | Multi Lane LLDF | Inv RF | Opr RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Comp. (kip) | IF | Tens. (kip) | IF | Comp. (kip) | Tens. (kip) | | | | |
| U5U6 | Upper-Chord | -127.44 | -159.45 | 1.22 | | | -596.47 | | 0.61 | | 1.65 | 2.76 |
| | | -127.44 | -159.45 | 1.22 | | | -596.47 | | | 0.61 | 1.65 | 2.76 |
| | | -127.44 | -159.45 | | | | -596.47 | | 0.61 | | 2.02 | 3.38 |
| | | -127.44 | -159.45 | | | | -596.47 | | | 0.61 | 2.02 | 3.38 |

**Load Factors** *6B.4.3 Manual for Bridge Evaluation, 2011*

| *Dead Load Factor* | *Live Load Factor for Inventory* | *Live Load Factor for Operating* |
|---|---|---|
| $A_1 := 1.30$ | $A_{2inv} := 2.17$ | $A_{2opr} := 1.30$ |

**Rating Factor Calculations** *Eq. 6B.4.1-1 Manual for Bridge Evaluation, 2011*

**HS-20 (Inventory)**

$$HS20_{RFinv} := \frac{C_{Member} - A_1 \cdot DL}{A_{2inv} \cdot HS20_{LL} \cdot IM \cdot DF}$$

$HS20_{RFinv} = 1.812$

**HS-20 (Operating)**

$$HS20_{RFopr} := \frac{C_{Member} - A_1 \cdot DL}{A_{2opr} \cdot HS20_{LL} \cdot IM \cdot DF} = 3.025$$

$HS20_{RFopr} = 3.025$

**VA Type 3 (Operating)**

$$VAType3_{RF} := \frac{C_{Member} - A_1 \cdot DL}{A_{2opr} \cdot VAType3_{LL} \cdot IM \cdot DF}$$

$VAType3_{RF} = 4.101$

**VA Type 3S2 (Operating)**

$$VAType3S2_{RF} := \frac{C_{Member} - A_1 \cdot DL}{A_{2opr} \cdot VAType3S2_{LL} \cdot IM \cdot DF}$$

$VAType3S2_{RF} = 3.492$

**BP-90 (Operating)**

$$BP90_{RF} := \frac{C_{Member} - A_1 \cdot DL}{A_{2opr} \cdot BP90_{LL} \cdot IM \cdot DF}$$

$BP90_{RF} = 2.795$

**BP-115 (Operating)**

$$BP115_{RF} := \frac{C_{Member} - A_1 \cdot DL}{A_{2opr} \cdot BP115_{LL} \cdot IM \cdot DF}$$

$BP115_{RF} = 2.793$

Note: Due to rounding of the results in the **Detailed Truss Member Rating Results** the rating factors may vary slightly from the Virtis rating factors.

**Load Rating Tonnage Calculations** *Eq. 6B.4.1-2 Manual for Bridge Evaluation, 2011*

**HS-20 (Inventory)**

$$HS20_{LRinv} = HS20_{RFinv} \cdot HS20$$

$$HS20_{LRinv} = 65 \cdot ton$$

**HS-20 (Operating)**

$$HS20_{LRopr} = HS20_{RFopr} \cdot HS20$$

$$HS20_{LRopr} = 108 \cdot ton$$

**VA Type 3**

$$VAType3_{LR} = VAType3_{RF} \cdot VAType3$$

$$VAType3_{LR} = 110 \cdot ton$$

**VA Type 3S2**

$$VAType3S2_{LR} = VAType3S2_{RF} \cdot VAType3S2$$

$$VAType3S2_{LR} = 139 \cdot ton$$

**BP-90**

$$BP90_{LR} = BP90_{RF} \cdot BP90$$

$$BP90_{LR} = 125 \cdot ton$$

**BP-115**

$$BP115_{LR} = BP115_{RF} \cdot BP115$$

$$BP115_{LR} = 160 \cdot ton$$

Note: Due to rounding of the results in the **Detailed Truss Member Rating Results** the rating tonnages may vary slightly from the Virtis rating tonnages.

# APPENDIX F: RATING FACTOR AND TONNAGE CALCULATIONS FOR STRINGERS

## Overview

The Purpose of this Mathcad sheet is to calculate rating factors and tonnages for vehicle configurations in the Virginia Department of Transportation Structure and Bridge Division's Instructional and Informational Memorandum IIM-S&B-27.6.

This sheet does not provide any analysis calculations, but only provides calculations for rating factors and load ratings using output from Virtis 6.2 using the BRASS LFD engine for ***steel stringers*** *of* truss bridges in ***flexure***.

## References

AASHTO 2011, *The Manual for Bridge Evaluation*, Second Edition

AASHTO 1996 with 1997 and 1998 Interim Revisions, Standard *Specifications for Highway Bridges*, Sixteenth Edition

VDOT Structure and Bridge Division Instructional and Informational Memorandum 27.6, January 7, 2008 (IIM-S&B-27.6)

## Notes

1. Input cells are highlighted in yellow.
2. Only LFD analysis modules can be used to analyze trusses in Virtis 6.2.

## VDOT Vehicle Configuration Tonnages

| *Design Vehicles* | *Legal Vehicles* | *Permit Vehicles* |
|---|---|---|
| HS20 := 36·ton | VAType3 := 27·ton | BP90 := 45·ton |
| | VAType3S2 := 40·ton | BP115 := 57.5·ton |

## Member of Interest

U2S1 at 7.00 ft

Note: For this example, the controlling stringer is the member of interest at midspan. The exterior stringers control for any stringer unit.

## Dead Load Moments

*Girder Weight*

$GW := 0.73 \cdot kip \cdot ft$

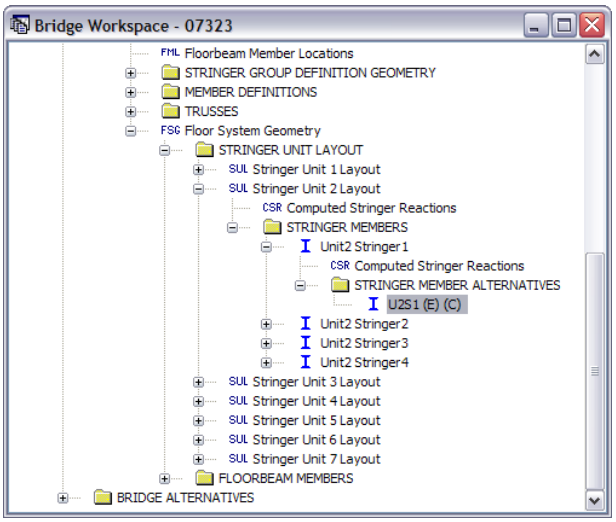
*Superimposed Uniform Dead Load*

$SUDL := 4.94 \cdot kip \cdot ft$

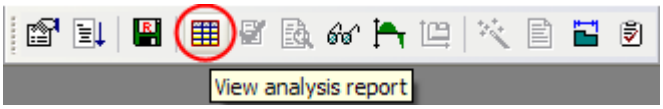
$DL := GW + SUDL = 5.67 \cdot ft \cdot kip$

$DL = 5.67 \cdot ft \cdot kip$

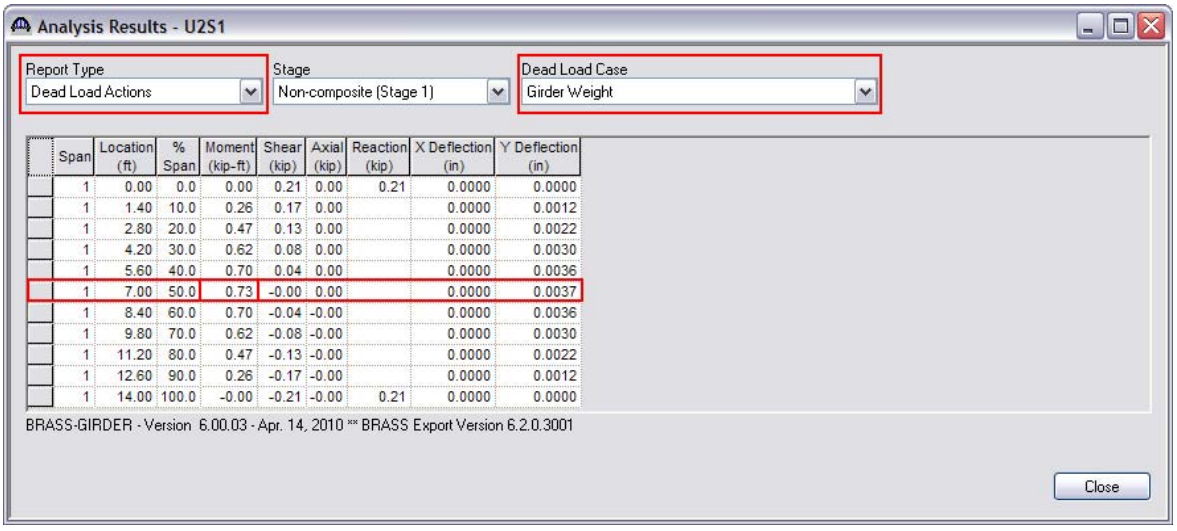
1. Analyze the member of interest, **U2S1 (E) (C)**, and highlight the member alternative.




2. Left click the **View Analysis Report** icon.




3. Change the report type to **Dead Load Actions**. Then change the dead load case to retrieve the necessary dead load moments.




| Span | Location (ft) | % Span | Moment (kip-ft) | Shear (kip) | Axial (kip) | Reaction (kip) | X Deflection (in) | Y Deflection (in) |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.0 | 0.00 | 0.21 | 0.00 | 0.21 | 0.0000 | 0.0000 |
| 1 | 1.40 | 10.0 | 0.26 | 0.17 | 0.00 | | 0.0000 | 0.0012 |
| 1 | 2.80 | 20.0 | 0.47 | 0.13 | 0.00 | | 0.0000 | 0.0022 |
| 1 | 4.20 | 30.0 | 0.62 | 0.08 | 0.00 | | 0.0000 | 0.0030 |
| 1 | 5.60 | 40.0 | 0.70 | 0.04 | 0.00 | | 0.0000 | 0.0036 |
| 1 | 7.00 | 50.0 | 0.73 | -0.00 | 0.00 | | 0.0000 | 0.0037 |
| 1 | 8.40 | 60.0 | 0.70 | -0.04 | -0.00 | | 0.0000 | 0.0036 |
| 1 | 9.80 | 70.0 | 0.62 | -0.08 | -0.00 | | 0.0000 | 0.0030 |
| 1 | 11.20 | 80.0 | 0.47 | -0.13 | -0.00 | | 0.0000 | 0.0022 |
| 1 | 12.60 | 90.0 | 0.26 | -0.17 | -0.00 | | 0.0000 | 0.0012 |
| 1 | 14.00 | 100.0 | -0.00 | -0.21 | -0.00 | 0.21 | 0.0000 | 0.0000 |

## Live Load Moments

*Design Vehicles*

$HS20_{LL} := 58.73 \cdot kip \cdot ft$

*Legal Vehicles*

$VAType3_{LL} := 44.93 \cdot kip \cdot ft$

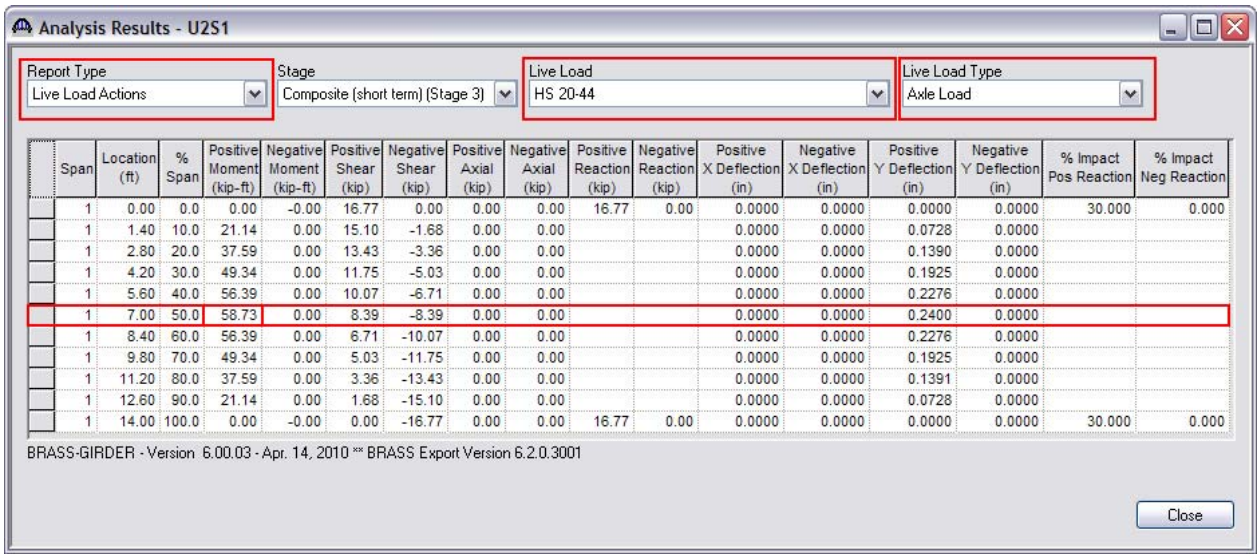
$VAType3S2_{LL} := 44.93 \cdot kip \cdot ft$

*Permit Vehicles*

$BP90_{LL} := 58.15 \cdot kip \cdot ft$

$BP115_{LL} := 60.88 \cdot kip \cdot ft$

1. Change the report type to **Live Load Actions**. Then change the live load and live load type

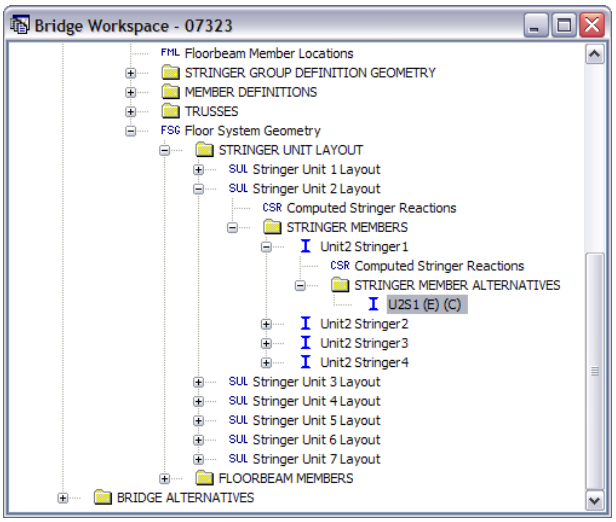



| Span | Location (ft) | % Span | Positive Moment (kip-ft) | Negative Moment (kip-ft) | Positive Shear (kip) | Negative Shear (kip) | Positive Axial (kip) | Negative Axial (kip) | Positive Reaction (kip) | Negative Reaction (kip) | Positive X Deflection (in) | Negative X Deflection (in) | Positive Y Deflection (in) | Negative Y Deflection (in) | % Impact Pos Reaction | % Impact Neg Reaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.00 | 0.0 | 0.00 | -0.00 | 16.77 | 0.00 | 0.00 | 0.00 | 16.77 | 0.00 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 30.000 | 0.000 |
| 1 | 1.40 | 10.0 | 21.14 | 0.00 | 15.10 | -1.68 | 0.00 | 0.00 | | | 0.0000 | 0.0000 | 0.0728 | 0.0000 | | |
| 1 | 2.80 | 20.0 | 37.59 | 0.00 | 13.43 | -3.36 | 0.00 | 0.00 | | | 0.0000 | 0.0000 | 0.1390 | 0.0000 | | |
| 1 | 4.20 | 30.0 | 49.34 | 0.00 | 11.75 | -5.03 | 0.00 | 0.00 | | | 0.0000 | 0.0000 | 0.1925 | 0.0000 | | |
| 1 | 5.60 | 40.0 | 56.39 | 0.00 | 10.07 | -6.71 | 0.00 | 0.00 | | | 0.0000 | 0.0000 | 0.2276 | 0.0000 | | |
| 1 | 7.00 | 50.0 | 58.73 | 0.00 | 8.39 | -8.39 | 0.00 | 0.00 | | | 0.0000 | 0.0000 | 0.2400 | 0.0000 | | |
| 1 | 8.40 | 60.0 | 56.39 | 0.00 | 6.71 | -10.07 | 0.00 | 0.00 | | | 0.0000 | 0.0000 | 0.2276 | 0.0000 | | |
| 1 | 9.80 | 70.0 | 49.34 | 0.00 | 5.03 | -11.75 | 0.00 | 0.00 | | | 0.0000 | 0.0000 | 0.1925 | 0.0000 | | |
| 1 | 11.20 | 80.0 | 37.59 | 0.00 | 3.36 | -13.43 | 0.00 | 0.00 | | | 0.0000 | 0.0000 | 0.1391 | 0.0000 | | |
| 1 | 12.60 | 90.0 | 21.14 | 0.00 | 1.68 | -15.10 | 0.00 | 0.00 | | | 0.0000 | 0.0000 | 0.0728 | 0.0000 | | |
| 1 | 14.00 | 100.0 | 0.00 | -0.00 | 0.00 | -16.77 | 0.00 | 0.00 | 16.77 | 0.00 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 30.000 | 0.000 |

Note: User should use the maximum moment between the axle load and lane load for the HS20 vehicle.

## Capacity

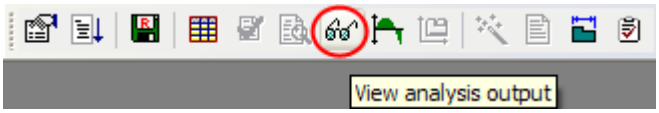
1. Analyze the member of interest, **U2S1 (E) (C)**, and highlight the member alternative.



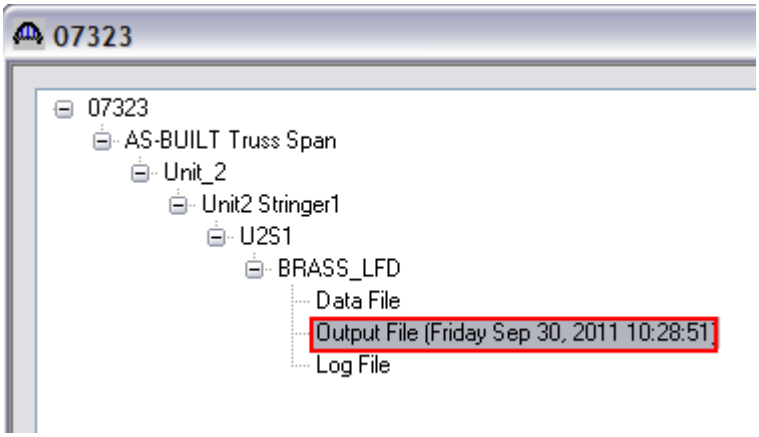

*Capacity for Strength* $C_{STR} := 179.6 \cdot kip \cdot ft$

*Capacity for Service* $C_{SER} := 128.6 \cdot kip \cdot ft$

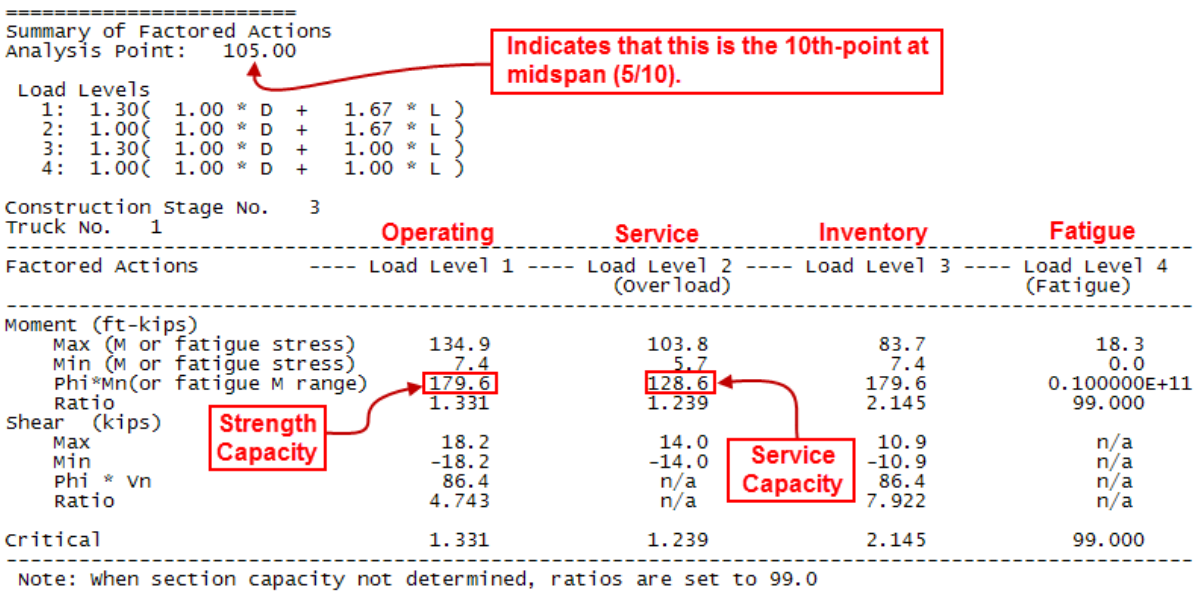
2. Left click the **View Analysis Output** icon.




3. Left click **Output File** under BRASS LFD.



4. The BRASS LFD output file will open. Scroll down to the Factored Actions section for the the controlling location.



```
========================
Summary of Factored Actions
Analysis Point:   105.00

 Load Levels
   1:  1.30(  1.00 * D  +   1.67 * L )
   2:  1.00(  1.00 * D  +   1.67 * L )
   3:  1.30(  1.00 * D  +   1.00 * L )
   4:  1.00(  1.00 * D  +   1.00 * L )

Construction Stage No.   3
Truck No.   1                          Operating      Service      Inventory      Fatigue
-------------------------------------------------------------------------------------------
Factored Actions          ---- Load Level 1 ---- Load Level 2 ---- Load Level 3 ---- Load Level 4
                                                  (Overload)                     (Fatigue)
-------------------------------------------------------------------------------------------
Moment (ft-kips)
    Max (M or fatigue stress)      134.9          103.8          83.7           18.3
    Min (M or fatigue stress)        7.4            5.7           7.4            0.0
    Phi*Mn(or fatigue M range)     179.6          128.6         179.6     0.100000E+11
    Ratio                          1.331          1.239         2.145           99.000
Shear  (kips)
    Max                             18.2           14.0          10.9             n/a
    Min                            -18.2          -14.0         -10.9             n/a
    Phi * Vn                        86.4            n/a          86.4             n/a
    Ratio                          4.743            n/a         7.922             n/a

Critical                           1.331          1.239         2.145           99.000
-------------------------------------------------------------------------------------------
 Note: When section capacity not determined, ratios are set to 99.0
```

**Load Factors for Strength** *6B.4.3 Manual for Bridge Evaluation, 2011*

| *Dead Load Factor* | *Live Load Factor for Inventory* | *Live Load Factor for Operating* |
|---|---|---|
| $A_1 := 1.30$ | $A_{2inv} := 2.17$ | $A_{2opr} := 1.30$ |

**Rating Factor Calculations for Strength** *Eq. 6B.4.1-1 Manual for Bridge Evaluation, 2011*

**HS-20 (Inventory)**

$$HS20_{RFinvSTR} := \frac{C_{STR} - A_1 \cdot DL}{A_{2inv} \cdot HS20_{LL}}$$

$HS20_{RFinvSTR} = 1.351$

**HS-20 (Operating)**

$$HS20_{RFoprSTR} := \frac{C_{STR} - A_1 \cdot DL}{A_{2opr} \cdot HS20_{LL}}$$

$HS20_{RFoprSTR} = 2.256$

**VA Type 3 (Operating)**

$$VAType3_{RFSTR} := \frac{C_{STR} - A_1 \cdot DL}{A_{2opr} \cdot VAType3_{LL}}$$

$VAType3_{RFSTR} = 2.949$

**VA Type 3S2 (Operating)**

$$VAType3S2_{RFSTR} := \frac{C_{STR} - A_1 \cdot DL}{A_{2opr} \cdot VAType3S2_{LL}}$$

$VAType3S2_{RFSTR} = 2.949$

**BP-90 (Operating)**

$$BP90_{RFSTR} := \frac{C_{STR} - A_1 \cdot DL}{A_{2opr} \cdot BP90_{LL}}$$

$BP90_{RFSTR} = 2.278$

**BP-115 (Operating)**

$$BP115_{RFSTR} := \frac{C_{STR} - A_1 \cdot DL}{A_{2opr} \cdot BP115_{LL}}$$

$BP115_{RFSTR} = 2.176$

Note: Due to rounding of the results in the LFD BRASS output, the rating factors may vary slightly from the Virtis rating factors.

**Load Factors for Service** *6B.5.3 Manual for Bridge Evaluation, 2011*

| *Dead Load Factor* | *Live Load Factor for Inventory* | *Live Load Factor for Operating* |
|---|---|---|
| $A_3 := 1.00$ | $A_{4inv} := 1.67$ | $A_{4opr} := 1.00$ |

**Rating Factor Calculations for Service** *Eq. 6B.4.1-1 Manual for Bridge Evaluation, 2011*

**HS-20 (Inventory)**

$$HS20_{RFinvSER} := \frac{C_{SER} - A_3 \cdot DL}{A_{4inv} \cdot HS20_{LL}}$$

$HS20_{RFinvSER} = 1.253$

**HS-20 (Operating)**

$$HS20_{RFoprSER} := \frac{C_{SER} - A_3 \cdot DL}{A_{4opr} \cdot HS20_{LL}}$$

$HS20_{RFoprSER} = 2.093$

**VA Type 3 (Operating)**

$$VAType3_{RFSER} := \frac{C_{SER} - A_3 \cdot DL}{A_{4opr} \cdot VAType3_{LL}}$$

$VAType3_{RFSER} = 2.736$

**VA Type 3S2 (Operating)**

$$VAType3S2_{RFSER} := \frac{C_{SER} - A_3 \cdot DL}{A_{4opr} \cdot VAType3S2_{LL}}$$

$VAType3S2_{RFSER} = 2.736$

**BP-90 (Operating)**

$$BP90_{RFSER} := \frac{C_{SER} - A_3 \cdot DL}{A_{4opr} \cdot BP90_{LL}}$$

$BP90_{RFSER} = 2.114$

**BP-115 (Operating)**

$$BP115_{RFSER} := \frac{C_{SER} - A_3 \cdot DL}{A_{4opr} \cdot BP115_{LL}}$$

$BP115_{RFSER} = 2.019$

Note: Due to rounding of the results in the LFD BRASS output, the rating factors may vary slightly from the Virtis rating factors.

**Load Rating Tonnage Calculations** *Eq. 6B.4.1-2 Manual for Bridge Evaluation, 2011*

Note: Mathcad sheet uses the controlling load factors (Strength vs. Service) to calculate the load rating tonnages.

**HS-20 (Inventory)**

$HS20_{LRinv} = HS20_{RFinv} \cdot HS20$

$HS20_{LRinv} = 45 \cdot ton$ $Controls1 = "SERVICE"$

**HS-20 (Operating)**

$HS20_{LRopr} = HS20_{RFopr} \cdot HS20$

$HS20_{LRopr} = 75 \cdot ton$ $Controls2 = "SERVICE"$

**VA Type 3**

$VAType3_{LR} = VAType3_{RF} \cdot VAType3$

$VAType3_{LR} = 73 \cdot ton$ $Controls3 = "SERVICE"$

**VA Type 3S2**

$VAType3S2_{LR} = VAType3S2_{RF} \cdot VAType3S2$

$VAType3S2_{LR} = 109 \cdot ton$ $Controls4 = "SERVICE"$

**BP-90**

$BP90_{LR} = BP90_{RF} \cdot BP90$

$BP90_{LR} = 95 \cdot ton$ $Controls5 = "SERVICE"$

**BP-115**

$BP115_{LR} = BP115_{RF} \cdot BP115$

$BP115_{LR} = 116 \cdot ton$ $Controls6 = "SERVICE"$

Note: Due to rounding of the results in the LFD BRASS output, the rating tonnages may vary slightly from the Virtis rating tonnages.

# APPENDIX G: LFD RATING FORM

VDOT Virginia Department of Transportation

Structure and Bridge

## LOAD RATING SUMMARY FORM FOR STRUCTURES

Rte.: 00645, Tapps Ford Road
Over: Rappahannock River

Va. Str. No.: 6903
Fed. ID: 07323

County: Fauquier
District: Culpeper

Rated By: ABC Date: 11/01/11
Checked By: XYZ Date: 11/17/11
VDOT Reviewer: _____

Signature: _____
Name: _____ Date:_____

Calculation Tools/Method Used: Virtis 6.2 – BRASS LFD Engine
Basis for Rating:

| | GVW (TONS) | RATING | CONTROLLING MEMBERS | CONTROLLING LOCATION (FT) | CONTROLLING FORCE |
|---|---|---|---|---|---|
| **DESIGN LOAD** | | FACTOR | | | |
| ***HL-93 (INV) | N/A | --- | --- | --- | --- |
| ***HL-93 (OPR) | N/A | --- | --- | --- | --- |
| | | TONS | | | |
| HS-20 (INV) | 36 | 45 | Ext. Stringers | 7.00 ft | Serviceability - Steel |
| HS-20 (OPR) | 36 | 75 | Ext. Stringers | 7.00 ft | Serviceability - Steel |
| **LEGAL LOADS** | | TONS | ** | | |
| VA Type 3 | 27 | 72 | Ext. Stringers | 8.40 ft | Serviceability - Steel |
| VA Type 3S2 | 40 | 107 | Ext. Stringers | 8.40 ft | Serviceability - Steel |
| *, ***LANE | 40 | --- | --- | --- | --- |
| **PERMIT LOAD** | | TONS | | | |
| BP-90 | 45 | 92 | Floorbeams | 6.25 ft | Serviceability - Steel |
| BP-115 | 57.5 | 113 | Floorbeams | 6.25 ft | Serviceability - Steel |
| **SH VEHICLES** | | TONS | ** | | |
| NRL | 40 | --- | --- | --- | --- |
| SU4 | 27 | --- | --- | --- | --- |
| SU5 | 31 | --- | --- | --- | --- |
| SU6 | 34.75 | --- | --- | --- | --- |
| SU7 | 38.75 | --- | --- | --- | --- |

* Not applicable for single spans less than and equal to 200 feet.
** FOR LFR or ASD: Denote if it is a mid range or operating level for posting and provide the safe posting load.
*** Not applicable for LF/AS rating methods.
**** Denotes does not meet the rating requirements.

Consulting Firm, Inc.

VDOT Virginia Department of Transportation

Structure and Bridge

## LOAD RATING SUMMARY FORM FOR STRUCTURES

**INSPECTION REPORT USED FOR THIS RATING:** 0306903-000000000007323 04/25/2008

**ASSUMPTIONS/COMMENTS BY LOAD RATING ENGINEER:**

Bridge No. 07323 – One Simple Span Steel Pony Truss Bridge

1. Plan 286-07 was used for the analysis.

2. An additional self load of 0.359 kip/ft was applied to each truss to account for the gusset plates, railing, bolts, etc.

3. Fictitious end floorbeams were modeled in the Virtis analysis file. The vertical forces placed on the truss at the ends due to the fictitious floorbeams were then added to the truss input as an upward load since Virtis cannot handle a truss without an end floorbeam.